

EVALUATION OF COMMERCIAL ADDRESS LISTS FOR THE 1990 DECENNIAL CENSUS

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A. INTRODUCTION

Over the past two decades, the United States Bureau of the Census has transformed the decennial census from a list and enumeration procedure applied in all areas of the country into an operation that depends almost exclusively on a mailout/mailback procedure with associated coverage improvement programs. For each decennial census prior to 1970, every address was listed and enumerated by census enumerators using maps and address listing registers. The first decennial census for which the mailout/mailback enumeration technique was utilized was the 1970 census. About 60 percent of the population in 1970 was mailed a questionnaire with instructions to complete and mail back the questionnaire. Households for which a questionnaire was not returned by mail were visited by enumerators during a nonresponse follow-up operation. This procedure was applied very effectively in 1970.

Due to its effectiveness in the 1970 census, the mailout/mailback procedure was utilized in the 1980 census to enumerate about 95 percent of the population.

The 1990 census will also employ the mailout/mailback procedure in two types of areas: Tape Address Register (TAR) and Prelist.

TAR areas include the highly urbanized portions of the United States which meet three conditions:

1. A commercial mailing list exists for the areas;
2. The areas receive city mail delivery from the United States Postal Service (USPS); and
3. Addresses in these areas can be assigned geographic codes from the computer files maintained by the Bureau of the Census.

For these areas, the commercial address list serves as the basis of the census address file. The commercial list is selected through a competitive procurement process. The complete address list supplied by the winning vendor(s) is then updated through several coverage improvement operations.

Mailout/mailback areas that do not satisfy one or more of the TAR conditions for compiling the initial list are called Prelist areas. The Census Bureau conducts a Prelist operation in these areas during which enumerators compile an address list. The enumerators are supplied with a map of a given area and a listing register.

The enumerators canvass the areas in a systematic fashion and list every housing unit they find. The Prelist address list is then updated as a result of several coverage improvement operations.

Since use of the commercial address lists are limited to TAR areas the following discussion pertains only to TAR. It should be noted that certain results of the evaluation of vendor lists (e.g., estimated coverage rates and cost per address) are procurement sensitive information that cannot be divulged. For this reason, results such as these are not included in this paper.

B. MAILING LIST EVALUATION FOR THE 1980 CENSUS

The following discussion of the 1980 Mailing List Evaluation is based on information contained in references made accessible to the authors which documented the methodology and results of the 1980 evaluation. Some items of interest were not documented for the 1980 evaluation and, thus, are not included in this paper.

1. Background

The mailing list evaluation for the 1980 census involved a comparison of commercial lists based on various factors. Each factor was assigned a point value which indicated its importance relative to the other factors. The factors and their point values were as follows:

- a. Coverage (80 points); The completeness of the address list based on a match of a sample of the list to an independent address inventory.
- b. Quantity (50 points); The number of TAR areas and the number of addresses represented on the vendor list.
- c. Carrier Route Coverage (10 points); The presence and quality of carrier route designations within ZIP Codes.
- d. Demonstrated Capability
 - Company Experience (10 points); The experience of the vendor in supplying comprehensive address lists.
 - Key Personnel (10 points); The experience and expertise of the company's key personnel in supplying such lists.
- e. Cost (40 points); The price per address.

The maximum number of points was 200.

2. Sample Design for Estimation of Coverage

To conduct the 1980 coverage evaluation, each vendor listed specific

TAR areas for which they could provide an address list. The 276 TAR areas in the United States (circa 1975) were then stratified into 18 groups based on list availability by vendor, 1970 housing unit count, and geography.

To estimate the coverage of the address lists, it was necessary to match the vendor lists to an independent address source. This independent source was compiled from sample addresses in TAR areas whose existence was verified by the Census Bureau's Current Population Survey (CPS). The sample of addresses for CPS are comprised of compact clusters of 4 adjacent housing units. There were 44 TAR areas not represented by sample addresses from the CPS, so these TAR areas were not involved in the estimation procedure and any results obtained from the evaluation were not applicable to these TAR areas. However, since no viable options were available, the results for a given TAR group were applied to all TAR areas in the group regardless of representation by the CPS.

The Census Bureau wanted the CPS sample to be large enough to ensure a difference of 3 percent or more in coverage rates of 2 vendor lists would be significant at the 95 percent confidence level. Under various assumptions the sample size was determined to be 1200 addresses per TAR group.

Within each TAR group, a list of the unique street (including name, prefix, suffix, and type) and ZIP Code combinations represented by the CPS sample addresses was compiled. Each vendor was asked to supply all addresses in its file for each of the street and ZIP Code combinations. Independently for each vendor, the address list was compared to the CPS sample addresses.

Estimated coverage rates produced from the CPS sample were much lower than the 85 percent experienced in the 1970 evaluation (see Section B.4). The Census Bureau thought that the list of street and ZIP Code combinations from the CPS sample could be inaccurate (e.g., due to changes since the CPS information was gathered). To determine if corrections to this information were needed, street and ZIP Code combinations for which one or more vendors did not supply addresses were compared to information on the most current address listing sheets used by CPS interviewers. Each vendor was then given a new list of the street and Zip Code combinations (including any corrections) for which it initially did not provide any addresses. The vendor was asked to supply the addresses in its file for the new list of street and ZIP Code combinations and to indicate why these addresses were not provided with the initial set of addresses. The

vendor addresses supplied as a result of the second request were then compared to the CPS sample listings.

3. Estimation Procedure

Since the CPS is a stratified systematic sample of housing unit clusters, an unbiased estimate of the coverage rate and an estimate of the variance of the coverage rate estimate for a given vendor and TAR group could be calculated using the standard formulas.

4. Results of the Coverage Evaluation

The highest estimated coverage rates by TAR group from the initial match of the vendor samples to the CPS addresses ranged from 56 to 76 percent (standard errors on these percents were about 1 percent). After the vendors supplemented their samples to account for corrected street and ZIP Code combinations, the highest estimated coverage rates ranged from 64 to 85 percent (standard errors were about 1 percent). While the supplementary match increased the estimated coverage rates considerably, even these were in most cases much lower than the anticipated 85 percent levels. It should be noted that for some TAR groups the list with the highest estimated coverage rate did not win the award because the list did not contain unit designations.

5. Problems Encountered During the Evaluation

The problems described below occurred during the evaluation of the vendor address lists. The problems can be classified into three categories; those due to the vendor lists, those due to the estimation procedure, and those due to the CPS File. Some of these are described in reference 1/.

a. Problems With the Vendor Address Lists

Of the seven vendors that expressed interest in the contract, one did not meet the specified terms, two did not contain any unit designations for addresses at multiunit basic street addresses (BSAs), and three lacked these unit designations for some but not all TAR areas in which they competed. The unit designations were required by the Bureau to distinguish addresses at multiunit BSAs.

For some core urban areas the address lists had not been updated for quite some time. There was no incentive for the vendors to improve their lists in areas such as these where a large proportion of the people live in poverty because the vendors were usually employed to conduct mailings for commercial purposes.

The coverage and quality of the address lists were less than anticipated. The expected housing unit count in TAR areas was 52 million and the vendors supplied 43 million unique

addresses (83 percent estimated coverage rate) and 5 million duplicates (12 percent of the lists). The lack of unit designations previously mentioned was another indication that the quality of the lists was less than expected.

b. Problems With the Estimation Procedure

The vendor addresses were compared to CPS sample addresses to determine coverage. This may not be the most appropriate comparison procedure for the following three reasons:

1) The vendors sort their files by ZIP Code and carrier route number whereas the CPS sample was defined by street and ZIP Code. The vendors may have had difficulty in stripping off their addresses for specified street and ZIP Code combinations.

2) The CPS is conducted by personal interview where the vendors have only mailing addresses.

3) Only about 78 percent of the TAR areas were represented by the CPS sample.

For these reasons the estimated rates for the evaluation were lower than anticipated.

c. Drawbacks with Using the CPS File

The existence of the CPS addresses was verified by interviewers 16 months or more before the addresses were available for this evaluation. A significant number of CPS addresses could have become invalid in that time due to demolitions or corrections.

C. THE 1990 CENSUS MAILING LIST EVALUATION

1. Background

The evaluation of address lists for the 1990 census compared the vendor lists with respect to several factors. The evaluation factors were assigned weights based on relative importance for usage in the census. For a given factor, points were awarded based on the vendor's estimated quality relative to the other vendors. A brief description of the factors and their respective point values are given below.

a. Coverage (75 points); The completeness of the address list based on the estimated number of valid addresses in the list.

b. Quality (10 points); The utility of the address list in terms of the percentage that are recognized by the USPS and the percentage of listing for units at multiunit BSAs which have unit designations.

c. Demonstrated Capability (15 points); Consisting of Company Experience and Key Personnel. These factors were evaluated based on information supplied by the vendor that detailed the experience of the company and of its key staff members in

supplying comprehensive address lists.

d. Cost (50 points); The price per address to procure the address list was used to award points for cost.

The maximum number of points was 150. In 1980 the vendor lists were also evaluated based on Quantity and Carrier Route Coverage. These characteristics were not evaluated separately in 1990 because they were involved to some degree in the evaluation of list coverage as described below.

2. Alternatives for Evaluation of Coverage

The Bureau of the Census wanted to design the evaluation of the vendor address lists in such a way that the problems experienced in 1980 would be avoided. Many of the difficulties faced in 1980 were due to the following:

- The CPS sample may not have been the most appropriate list to determine the coverage of vendor lists since the CPS addresses were not used for mailing purposes, had their existence verified at least sixteen months before the evaluation started, and did not represent all TAR areas;

- The vendor lists were organized by ZIP Code and carrier route, not by street and ZIP Code as were the CPS addresses. For this reason, the vendors may have had a difficult time supplying the appropriate addresses.

To overcome these problems, the Bureau decided to base the evaluation of coverage on the vendor addresses supplied for a sample of carrier routes within ZIP Codes. Given this, three methods of conducting the coverage evaluation were identified.

a. Match the sample vendor lists to a sample of CPS addresses in a procedure similar to that used in 1980. In addition to many of the drawbacks described in Section B.5, each CPS address would have to be matched to the Carrier Route Identification System file maintained by the USPS to determine the appropriate carrier route and ZIP Code. This procedure had not been conducted before on a large scale so the percentage of CPS addresses that would be assigned a carrier route and ZIP Code was not estimable.

b. Match the sample vendor lists to the 1980 census list. The addresses added in the coverage improvement operations (USPS checks, Precanvass, etc.) would have to be keyed and added to the vendor files used in 1980 to support this procedure. Also, listings of addresses built since 1980 (which do not include unit designations for multiunit BSAs) and addresses demolished after 1980 would have to be merged with the updated 1980 list.

c. Unduplicate and merge the sample vendor lists, then have the USPS determine which addresses are

deliverable. Most if not all of the vendors use the USPS to update their lists and the USPS is the best source to verify that mail can be delivered to a given address. In addition, the Bureau would request each vendor to supply the number of residential addresses in its list for each city delivery carrier route in a ZIP Code that was wholly or partially in a TAR area.

Due to the weaknesses of methods a and b and the strengths of method c, the procedure involving the merging of the sample vendor lists and the USPS check was selected for use in 1990. Since this procedure did not request that the USPS estimate the number of residential addresses missing from the vendor lists, a method was needed to identify areas for which the vendor lists had severe undercoverage. The Bureau decided to compare the estimated count of valid addresses from the vendor lists (using the proportion of valids in the sample) to the number of residential stops for city delivery carrier routes on the Delivery Statistics file maintained by the USPS.

3. Sample Design for Coverage

The United States contained 345 TAR areas when the evaluation was designed in 1986. The total number of sample carrier routes necessary to conduct an evaluation separately for each TAR area would have been excessive. To meet the criteria of the evaluation and maintain cost at a reasonable level, the TAR areas were stratified by geography and vendor availability into 21 groups. The groups consisted of whole or partial ZIP Codes in the TAR areas. These ZIP Codes were identified by the Geography Division at the Bureau by matching the TAR area definitions to the January, 1987 version of the USPS ZIP Code file. Criteria used as guidelines to form the groups are listed below in priority order.

- a. Groups should contain entire three digit ZIP Code areas.
- b. Groups should contain contiguous TAR areas.
- c. Groups should contain entire states.
- d. Groups should represent a sufficient number of housing units so that vendors are interested in competing for the contract.

The vendors could compete for as many groups as they wanted and the evaluation was conducted separately for each group.

The sampling frame for the evaluation was the list of city delivery carrier routes with residential addresses in ZIP Codes at least partially contained in TAR areas. The average number of residential addresses in these carrier routes was about 500. The Bureau did not want to select carrier routes that contained less than 25 percent of the

average count since small carrier routes could substantially increase the between carrier route component of variance estimates.

Thus, the carrier routes were sorted by carrier route number within ZIP Code and then clustered within ZIP Code until the cluster contained at least 125 residential addresses or the entire ZIP Code was in one cluster. The carrier route cluster was the sampling unit for the evaluation.

The Bureau wanted enough carrier routes in sample to ensure a difference of 2 percent or more in coverage rates between two lists would be significant at the 95 percent confidence level. The assumptions used were similar to those for 1980 except the coverage rates were expected to be around 70 percent instead of 85 percent. Under these assumptions the sample size was determined to be 418 carrier route clusters per TAR group.

4. Processing the Vendor Samples

Three vendors met the evaluation criteria for at least one TAR group by supplying their housing unit counts for city delivery carrier routes within TAR ZIP Codes and their lists of addresses for the sample carrier route clusters.

The sample of addresses supplied by the vendors for a given TAR group were processed in three operations. The results from these procedures were used to estimate the coverage of the vendor address lists.

The first operation performed on the sample vendor addresses was a computer edit to identify the unique addresses on one or more vendor lists for a given TAR area. Each vendor list was examined to identify within list duplicates and the duplicates were deleted from the list. A between list comparison of a given address to the addresses in the same ZIP Code and carrier route on the other vendor lists was conducted. Addresses on two vendor lists were matched if either of the following conditions were met.

- a. The addresses were the same on both vendor lists.
- b. Both vendor lists contained listings for addresses at the corresponding BSA. If one vendor had more listing at the BSA, the extra listings were nonmatches.

A code was assigned to each unique address which identified the vendor list(s) that contained the address.

The results of the computer match were used to conduct the second operation - a clerical match. The unique addresses were printed in registers for examination by clerks. The clerical matching rules were somewhat more liberal than those for the computer edit since minor spelling differences in street names or disagreement on street type (Road, Avenue, etc.) prefix, and suffix could

be ignored under certain circumstances.

The matching rules for the computer and clerical edits were conservative since a match of two addresses meant that only one would be processed in the final operation - a deliverability check by the USPS. Each of the 4.44 million unique sample addresses that remained after the computer and clerical matches were printed on cards. A code was also printed on the card to identify the vendor list(s) that contained a given address. The USPS check involved 9,012 carrier routes in 4844 Zip Codes. The USPS classified each address either as deliverable, undeliverable, or a duplicate of a deliverable address. To facilitate the operation, the Bureau did not instruct the USPS to make corrections to addresses or to list residential addresses for which cards were not supplied.

The list code was needed to classify the duplicates on a given vendor list as either within list or between list. Within list duplicates were counted against that vendor in terms of quality of the list. Between list duplicates were included in the number of valid addresses for that vendor (see Section C.5).

5. Estimation of Coverage

The results of the USPS check and the matches were used to compare estimated coverage rates for the lists. The lists were compared in pairs. The comparisons were not straightforward because the results of the USPS check for numerous carrier routes were not received in time to be involved in the evaluation. The Bureau wanted to ensure these missing data did not affect comparisons of list coverage. The Bureau adjusted the results from the carrier routes checked-in in two ways to account for the missing results.

- Observed Estimate; Sample carrier routes not checked-in were assumed to behave similarly to those that were checked-in. Thus, the checked-in carrier routes were treated as a random subsample of the original sample of carrier routes to produce this estimate.

- Extreme Estimate; Within TAR group, the list with the highest observed estimate of coverage was determined. When comparing this list separately with each other list, it was assumed that, from the carrier routes not checked-in, all addresses only on the list with the higher observed estimate of coverage were not deliverable while those only on the other list were deliverable. As such, the extreme estimate of coverage for the list with the higher observed estimate of coverage is a lower bound for the estimate that would have been produced if all sample carrier routes were checked-in. The extreme estimate for the

other list is an upper bound for the estimate that would have resulted from the entire sample. Thus, if the extreme estimate of coverage for a given list is significantly better than that for another list, the coverage estimates would also be significantly different under any procedure devised to adjust the observed results for carrier routes that were not checked-in.

The observed estimate of the coverage rate for list i in comparison to list j was the ratio of the number of valid addresses on list i in a checked-in carrier route to the number of valid addresses on list i or list j in a checked-in carrier route.

An address on list i was valid if either -

- it was also on list j,
- it was not on list j but the USPS identified it as deliverable, or
- the USPS classified it as a duplicate of a deliverable address that was not on list i.

The extreme estimate of the coverage rate was also calculated. In the discussion below assume that list i had a higher observed estimate than list j.

The number of valid addresses on list i for the extreme estimate was the number of valids used for the observed estimate plus the number of addresses on both lists i and j in carrier routes that were not checked-in.

The number of valid addresses on list j for the extreme estimate was the number of valids used for the observed estimate plus the number of addresses in carrier routes not checked-in that were either on both lists i and j or only on list j.

The variance estimate for the difference between the coverage rates for two lists was calculated separately for each pair of lists and for the observed and extreme estimates. The Bureau used the standard approximation for the variance estimate of the ratio of two random variables (see reference 2/).

The Bureau conducted a two-tailed hypothesis test at the 90 percent confidence level for each coverage rate comparison. The results of these tests were as follows:

- For each TAR group, the selection of the list with the highest coverage was unaffected by the missing carrier routes, i.e., the observed and extreme estimates of coverage produced the same decision.

- The coverage rate for the best list was significantly better than those for the other lists in 20 of the 21 TAR groups.

6. Results of the Evaluation

The evaluation of vendor address lists for the 1990 census indicated that

the utility of these lists has increased since the evaluation for the 1980 census. In particular,

a. the estimated proportion of duplicate listings on the vendor lists awarded the contracts in 1990 (0.6 percent of the sample addresses) is much lower than the corresponding rate for 1980 (12 percent).

b. the estimated percentage of listings for units at multiunit basic street addresses that lacked unit designations on the vendor lists procured for the 1990 census was 1.3 percent. The corresponding rate for the 1980 evaluation is not available. However, as described in Section B.5.a missing unit designations were a big problem in 1980.

To identify TAR groups for which the awarded vendor list had severe undercoverage of addresses, the adjusted vendor count and the USPS residential stop count for city delivery carrier routes in TAR ZIP Codes were compared for each TAR group. The adjusted vendor count was calculated by taking the product of the vendor address count for the entire TAR group and the estimated proportion of valid addresses on the vendor list based on the sample of addresses returned from the USPS deliverability check. The residential stop counts were taken from the August, 1986 version of the USPS Delivery Statistics file. For 20 of the 21 TAR groups the ratio of the adjusted vendor count to the USPS residential stop count was at least 92 percent. The percent for the other group was very low. The Bureau will decide if it will be feasible to supplement this vendor list with some other address inventory (such as the 1980 census list). Overall, the ratio of the adjusted vendor count to the USPS residential stop count for all TAR areas was about 95 percent. It is clear that the coverage of the vendor lists is very good for all areas except for the one TAR group.

D. CONCLUSIONS

The evaluation of commercial address lists for the 1990 census was designed to overcome many of the problems encountered during the corresponding

evaluation for the 1980 census. The results of the 1990 evaluation indicate that the address lists for 1990 are of a higher quality and have sufficient coverage for more areas than those procured for the 1980 census. However, the Bureau cannot determine the true utility of the vendor address lists until after the 1990 census. Only then will the Bureau be able to calculate the number of vendor addresses enumerated in the 1990 census.

REFERENCES

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FOOTNOTES

¹This paper reports the general results of the research undertaken by the Census Bureau staff. The views expressed are attributable to the authors and do not necessarily reflect those of the Census Bureau.

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