

1990 CENSUS ADJUSTMENT PROCEDURES AND COVERAGE EVALUATION

HEARING
BEFORE THE
SUBCOMMITTEE ON
CENSUS AND POPULATION
OF THE
COMMITTEE ON
POST OFFICE AND CIVIL SERVICE
HOUSE OF REPRESENTATIVES
NINETY-NINTH CONGRESS

SECOND SESSION

JULY 24, 1986

Serial No. 99-65

Printed for the use of the Committee on Post Office and Civil Service



U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1986

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CONTENTS

	Page
Statement of:	
Barbara A. Bailar, Ph.D., Associate Director for Statistical Standards and Methodology, Bureau of the Census	2
Stephen E. Fienberg, Ph.D., chairman, Committee on National Statistics, and professor of statistics and social science, Carnegie Mellon University.....	29
Michael A. Stoto, associate professor of public policy, John F. Kennedy School of Government, Harvard University.....	70
Carl P. Carlucci, Ph.D., executive director, New York State Legislative Task Force on Demographic Research and Reapportionment.....	73
Eugene P. Ericksen, Ph.D., associate professor, Department of Sociology, Temple University, and special consultant, National Economic Research Associates, Inc.....	87
Joseph Waksberg, vice president, WESTAT, Inc	103
Statement submitted by:	
John W. Pratt, professor of business administration, Harvard University..	39
Additional material:	
"The Bicentennial Census: New Directions for Methodology in 1990," a summary by John W. Pratt and Constance F. Citro	44

1000

1990 CENSUS ADJUSTMENT PROCEDURES AND COVERAGE EVALUATION

THURSDAY, JULY 24, 1986

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON CENSUS AND POPULATION,
COMMITTEE ON POST OFFICE AND CIVIL SERVICE,
Washington, DC.

The subcommittee met, pursuant to call, at 10 a.m., in room 311, Cannon House Office Building, Hon. Robert Garcia (chairman of the subcommittee), presiding.

Mr. GARCIA. Good morning. I welcome all of you to our hearing today. We will be focusing on the Census Bureau's preparations for the evaluation of the 1990 census and considerations for improving the accuracy of the census.

When our Nation takes its bicentennial census in 1990, the most important goal is having an accurate count of the people. Accuracy will directly impact how fairly we calculate the number of seats each State will have in the House of Representatives and how Federal funds will be distributed.

Unfortunately, there can never be a perfect census in which everyone is counted. The problem of undercount has been with us since the very first census. Although the Census Bureau has made significant advances in reducing the problem of undercount, it is still a critical problem among urban areas and minority populations.

To compensate for the problem of undercount, some experts believe the census would be more accurate if the results were adjusted. Others argue that it will be hard to do the adjustment in time for congressional apportionment and would greatly increase the Bureau's discretion in determining the outcome of the count.

Today, we are privileged to have as witnesses distinguished panels of experts who are fully familiar with the census process. These experts will testify on the benefits and the weaknesses of adjustment, as well as on the importance of evaluating the census. I hope that through this hearing we can come to a better understanding of the procedures involved in improving the accuracy of the census.

I might add that some people may question why we are having this hearing so early; it is only 1986, and the census is approximately, 3½ years away. My answer to that is that we have been down this road before, and when it comes to the question of an undercount and adjustment procedures for the census you really can't start early enough.

My colleague, the ranking minority member of this subcommittee, will hopefully be joining us shortly, but he is at this point occupied with some very important meetings that he is attending. He has asked me to submit for the record his opening statement, and it will be inserted at this point.

STATEMENT BY HON. JAMES V. HANSEN

Mr. HANSEN. Mr. Chairman, I am happy to be with you today to continue our review of the Census Bureau's adjustment procedures and coverage evaluation.

The accuracy of census results has long been a concern. Even though the effort to improve the accuracy of the census it is still estimated that 1 to 2 percent of our population does not get counted. This is a problem that needs to be addressed but not surprisingly many of the suggested solutions are very controversial.

Mr. Chairman, I do have serious reservations regarding the adjustment of census figures not only because of the serious damage it could do to the proper execution of the census but also because of the political problems which could arise.

Our witnesses today will discuss some of the options available to the Bureau and will hopefully provide us with information that will enable this subcommittee and Congress to determine the best avenue to pursue.

Mr. GARCIA. Our first panel is going to be led by Dr. Barbara A. Bailer, who is the Associate Director for Statistical Standards and Methodology from the U.S. Bureau of the Census. Other members of that panel will be Dr. Steve Fienberg, who is the chairman of the Committee on National Statistics and a professor at Carnegie Mellon University. If Dr. Bailer and Dr. Fienberg are here, I would appreciate it if they would be kind enough to take a seat up front here.

STATEMENTS OF BARBARA A. BAILAR, PH.D., ASSOCIATE DIRECTOR FOR STATISTICAL STANDARDS AND METHODOLOGY, BUREAU OF THE CENSUS, AND STEPHEN E. FIENBERG, PH.D., CHAIRMAN, COMMITTEE ON NATIONAL STATISTICS, AND PROFESSOR OF STATISTICS AND SOCIAL SCIENCE, CARNEGIE MELLON UNIVERSITY

Dr. BAILAR. Thank you, Mr. Chairman. Thank you for this opportunity to brief the subcommittee. I will make my remarks brief and submit my full statement for the record.

Evaluations of coverage conducted since 1950 have shown a steady improvement in census coverage over four decades, from an undercount of over 4 percent for the total population in 1950 to an undercount in 1980 of 1 to 2 percent depending on the estimated number of illegal aliens in the country. Throughout this time there has been a persistent difference in the undercount rate for blacks as compared to the total population. Because there continues to be an undercount in the census, we have embarked on a dual strategy for the 1990 census. We will attempt to take the best census possible and count everyone, but we will also do what is necessary to be prepared to adjust the counts if we determine that adjustment will improve them.

Because the coverage evaluation studies of 1980 did not provide information accurate enough to adjust the census, we have undertaken a rigorous program of research, testing and evaluation of the various issues related to adjustment. To be able to adjust we have to do four things:

First, we have to establish methodologies to measure coverage accurately.

Second, we have to be able to develop acceptable statistical techniques to estimate coverage for small geographic levels and for a variety of population and housing characteristics.

Third, we have to establish and publish standards for evaluating the quality of the adjusted and unadjusted data.

Fourth, we have to implement the adjustment, compare the adjusted and unadjusted data in light of the standards, and then release one of the sets of data as the official 1990 census results.

This is an ambitious goal. We may not be able to estimate coverage and adjust for the count and characteristics in every census block by December 31, 1990. If we do not meet that date, we do have fall-back positions, but it would mean that there could be two sets of census results—the unadjusted numbers available on December 31, 1990, and an adjusted set available later. I will discuss each of the four major steps in adjustment as well as the issue of reaching consensus on them.

Mr. Chairman, the first issue I will talk about is the measurement of census coverage. We have tested several methods for measuring coverage and have decided on the two most promising methods: a postenumeration survey or PES, and demographic analysis. We are conducting extensive research and testing on the design of the PES for 1990.

First, we plan to select an independent sample for the 1990 PES rather than piggybacking on a sample drawn for another purpose as we did in 1980.

Second, we have more fully integrated the PES operations with the census operations. We would be able to start PES data collection and processing on a flow basis. This early start is essential if we are going to have any chance of completing adjustment by December 31, 1990.

Third, there are differences in the size and type of sample to be drawn.

Fourth, we are developing an automated matching system which, along with other new automation improvements for 1990 could give us the ability to match the PES sample to the census more accurately and more quickly than in 1980. We have been testing these and other improvements in our test censuses in 1985 in Tampa, FL, and in 1986 in central Los Angeles County and in east central Mississippi.

The other principal coverage evaluation method I will mention is demographic analysis. Demographic analysis involves the development of an estimate of the population from administrative data records essentially independent of the census. We will develop demographic analysis estimates of the size and distribution of 1990 coverage errors at the national level. We plan to use them in conjunction with the results of the PES to measure coverage of the 1990 census.

In early 1987, we will decide on the statistical and operational feasibility of adjustment. This is not a decision about whether the adjusted numbers will be the official 1990 census counts. What appears feasible in 1987 may or may not be feasible in 1990. The date for this decision is driven essentially by the timing of our budget request for 1990.

If we determine that adjustment is not technically feasible, then we would not go ahead with the full-scale adjustment program. We would likely propose a smaller, less costly undercount measurement program for the purposes of evaluation but not adjustment. If the decision is that we are statistically and operationally capable of adjustment, then we will plan work to permit adjustment. We will release the adjusted figures unless the final results do not meet technical standards that we are currently developing. Although we cannot say definitively at this time what our determination will be, our research thus far on most aspects of undercount measurement has been promising.

The second issue is making adjustments for small areas and for demographic characteristics. To avoid inconsistencies in our tabulations and publications, and confusion for our data users, we plan to adjust down to the block level and for as many characteristics as possible.

The third issue I will discuss is the standards for deciding whether it is statistically sound to adjust. We are developing and will announce well in advance of the census the standards we will use to assess whether the census counts or the adjusted figures are better. We want to reach a consensus among various stakeholders—Congress, the statistical community and others—in advance of the 1990 census on the criteria for judging the relative quality of the adjusted and unadjusted figures.

We are developing standards for both methodologies of estimating census undercount—the PES and demographic analysis. These two methodologies are very different and require different standards. The standards upon which the adjustment decision is to be based must depend upon observable results of the census and of the coverage measurement studies. These would be such things as the measured differential census undercount by race, ethnicity or geographic level, indicators of the quality of the data collected in the coverage measurement survey; and indications of the quality of the matching operation.

We continue to conduct research into census adjustment standards and plan to distribute the results of this research in the spring of 1987. After that we will begin an intensive schedule of consultation with data users including Federal agencies, professional statistical organizations and the Congress.

The fourth issue I will discuss is the public review of our plans for adjustment. We could not conduct the census without widespread support for our plans and goals. Neither can we contemplate adjustment without establishing a consensus of support, including congressional review, for our techniques and standards. We have consulted extensively with a wide range of interested individuals and groups. This hearing and the hearing before this subcommittee 2 years ago are part of that process. We have discussed adjustment planning with professional associations, the Census Bu-

reau's advisory committees, and at our annual research conferences. And we have benefited from the recommendations of the distinguished Panel on Decennial Census Methodology of the Committee on National Statistics of the National Academy of Sciences.

After the publication of our preliminary census adjustment standards early next year, we will hold a number of public forums to discuss the standards and other issues related to adjustment. In October 1987, we will publish the proposed standards in the Federal Register and review any comments we receive. And in May of 1988, we will submit materials on the proposed census adjustment standards for review by our congressional oversight committees.

Finally, I will discuss the decision to adjust the census. There are two main parts to the overall decision process. First, if the 1987 decision is that adjustment is statistically and operationally feasible, the machinery will be put in place. Coverage estimates will be made and population and housing estimates adjusted for undercount will be produced. We have stated that we will only release the adjusted data if it can be shown that the adjustment figures are better than the unadjusted counts. The 1987 adjustment decision will essentially represent the Census Bureau's judgment at that time about whether to prepare adjusted estimates.

Second, in December 1990, or as soon as the coverage measurements have been obtained, we will evaluate the measurements in light of the specified technical standards. This evaluation will be looking for any substantial unforeseen errors that might have occurred or other unanticipated serious flaws in the coverage measurement process that would cause us to view the adjusted data as farther from the truth than the unadjusted data.

Assuming the standards are met and such flaws have not occurred, we would release the adjusted data. But if our review indicates that serious errors occurred, then we would release the unadjusted data. To make that decision, we will convene a group of key Census Bureau statisticians and demographers. In addition, we will refer this matter to the Committee on National Statistics' Panel on Decennial Census Methodology and to the Census Advisory Committee of the American Statistical Association, perhaps augmented by some representatives selected from the Census Advisory Committee on Population Statistics. These outside experts will review the results of the census and the adjusted figures and make comparisons with the established standards. They will submit a report and recommendations to the internal technical group. The internal technical group will consider the external experts' report and recommendations, and will make recommendations to the Director of the Bureau of the Census. The Director will then make and issue the final decision.

The plan for determining whether to adjust has been designed to be independent of the judgment of only one individual. By developing standards that are agreed upon in advance, we are removing the need to trust the judgment of one specific person or any one concern. We believe that the decision must be based upon definite knowledge about the results of our coverage evaluation program and the quality of both the census and the evaluation. The key to this strategy is reaching consensus on the standards before the census is taken.

Mr. Chairman, that concludes my testimony on adjustment plans for the 1990 census, and I would be happy to answer any questions.

Mr. GARCIA. Thank you, Dr. Bailar.

[The statement of Dr. Bailar follows. Also included are responses to written questions.]

STATEMENT OF THE ASSOCIATE DIRECTOR FOR
STATISTICAL STANDARDS AND METHODOLOGY OF THE
BUREAU OF THE CENSUS

Barbara A. Bailar

Before the Subcommittee on Census and Population
Post Office and Civil Service Committee
U.S. House of Representatives
July 24, 1986

Introduction

Mr. Chairman, thank you for this opportunity to brief the Subcommittee on the issue of adjustment in the 1990 census.

Because of the many important uses of census data, completeness and quality have been a concern to census officials and data users since the first census. After the 1790 enumeration, President George Washington expressed disappointment that the population count did not exceed 4 million (it was 3,929,214). There was no way to measure undercount then, but Washington had a hunch that some people were reluctant to be counted.

The development of probability sampling methods, the improvement in demographic techniques, and the improvement in administrative record systems (such as birth and death registrations) in the middle decades of this century have made it possible to provide more scientific measures of the accuracy of census data. At the same time, there has been a growing interest in the quality of the counts, particularly for programs that use census data to allocate funds.

Since 1950, each census has included an evaluation and research program to measure coverage error. The main purpose of these evaluations has been to measure progress in reducing the undercounts and design programs to correct enumeration problems in the next census.

These evaluations have shown a steady improvement in net census coverage over four decades, from an undercount of over 4 percent for the total population in 1950 to an undercount in 1980 of 1 to 2 percent, depending on the estimated number of illegal aliens in the country. Throughout this time, there has been a persistent difference in the undercount rates for Blacks as compared to the total population. Although we have been able to reduce the undercount for all groups in the last few censuses, the undercount for Blacks has remained about 4.5 percentage points higher than the undercount for the total population. We know less about the Hispanic population (because of deficiencies in administrative records), but the data we have suggest that this segment of the population has also been disproportionately undercounted. Other differentials in undercount also exist, such as by geographic area and socio-economic characteristics.

Census undercount might not be of such great concern if it were spread evenly across population groups and geographical areas. But since differential undercounts do exist, there has been considerable discussion about their effect and possible solutions.

Since the early 1950's, some people have advocated that we adjust the census counts to correct for the undercount. Adjustment was a major

issue for the 1980 census. As I remarked in my testimony before this Subcommittee in April 1984, our coverage evaluation studies for the 1980 census did not provide us with information accurate enough to adjust the 1980 census data. They provided only a general idea of the degree of coverage error in the census.

Because there continues to be an undercount in the census, we have embarked on a dual strategy for the 1990 census: We will attempt to take the best census possible and to count everyone, but we also will do what is necessary to be prepared to adjust the counts if we determine that adjustment will improve them.

The first part of this strategy is to attempt to count everyone. For more than 40 years, we have been pursuing efforts to improve the census, and as I stated earlier, these efforts have been successful. But we also have seen the costs of the census rise as we commit more resources to the improvement of the data. We know that even if we had unlimited funds we would never be able to take a perfect census in which we count everyone.

That is why the second part of our strategy is to be prepared to adjust the census if we determine that adjustment will improve the counts. We have undertaken a rigorous program of research, testing, and evaluation of the various issues related to adjustment. To be able to adjust, we have to do four things: (1) We have to establish methodologies to measure coverage accurately; (2) we have to develop acceptable statistical techniques to estimate coverage for small geographic levels and for a variety of population

and housing characteristics; (3) we have to establish and publish standards for evaluating the quality of the adjusted and unadjusted data; and, (4) we have to implement the adjustment, compare the adjusted and unadjusted data in light of the standards, and then release one of the sets of data as the official 1990 census results.

This is an ambitious goal. It means that we need to carry out the adjustment while the census counts are being tabulated. We may not be able to estimate coverage and adjust for the count and characteristics in every census block by December 31, 1990. If we do not meet that date, we do have fallback positions; but it would mean that there could be two sets of census results--the unadjusted numbers available on December 31, 1990 and an adjusted set available later.

In the following sections, I will discuss each of the four major steps in adjustment, as well as the issue of reaching consensus on them.

Coverage Measurement Methodologies

Mr. Chairman, the first issue I will talk about is the measurement of census coverage. Before we can consider adjusting for an undercount, we must be able to measure it. We would, of course, plan to measure census coverage, as we have in the last four censuses, even if we determine not to pursue adjustment. We have tested several methods for measuring coverage and have decided on the two most promising methods--a post-enumeration survey and demographic analysis.

Post Enumeration Survey

The general thrust of our research program is toward a post-enumeration survey (PES) as the main tool for providing detailed data about coverage error. A PES will provide data on gross omissions and gross overenumerations, on subgroups of the population, and for substate areas. In a PES, we draw a sample of the population independently of the census. We enumerate the sample, asking where the persons lived on Census Day and various characteristics about them. We match each of the people in the sample to the census to determine whether the person was counted correctly in the census or missed in the census. In 1980, we drew our sample of about 168,000 households from two months of the Current Population Survey (CPS). We also reinterviewed about 110,000 households counted in the census to look for such errors as counting someone twice, counting someone in the wrong location, or counting someone not eligible to be enumerated under census residency rules.

Our experience with the PES has shown that there are problems with this methodology. For example, there can be incomplete data when enumerators are unable to complete an interview; there is difficulty in matching cases from the PES to the census; and there is the lack of independence between the PES and the census so that the same persons are missed in both the PES and the census. We are working to resolve these problems as much as possible, but we do not know at this time whether we will be successful or not.

We are conducting extensive research and testing on the design of the PES for 1990. I will now discuss our plans in four areas.

First, we plan to select an independent sample for the 1990 PES, rather than piggy-backing on a sample drawn for another purpose. We did the latter in 1980, when we used the CPS. For 1990, we will select a sample of census blocks and enumerate every household in them. The independent sample of blocks may be more accurate than the 1980 approach for a number of reasons, including reduced geographic assignment errors and reduced matching errors. In this approach we match the PES to the census and the census to the PES, following up unmatched cases in both directions. In 1980, we had two separate surveys to measure gross omissions and gross overenumerations with some balancing that did not work well.

Second, we have more fully integrated PES operations with the census. Our goal will be to complete basic census field work in as many offices as possible by July 1990. As field offices complete the enumeration, data collection for the PES would begin. We would be able to start PES data collection and processing on a flow basis. This early start is essential if we are going to have any chance of completing adjustment by December 31, 1990.

Third, there are differences in the size and type of sample to be drawn. In 1990, we will have one sample of about 300,000 households that will give us data on both missed persons and duplicate enumerations. In 1980, we had two samples: one of 168,000 households to give us data on missed persons and one of 100,000 households to give us data on duplicated persons.

Fourth, we are developing an automated matching system, which, along with other new automation improvements for 1990, could give us the ability to

match the PES sample to the census more accurately and more quickly than in 1980. A major problem with the 1980 PES was that the difficulty of matching cases from the CPS to the census led to a significant number of unresolved cases for which the enumeration status could not be determined. This problem was not unexpected and is inevitable, to some extent, in any matching study. Unresolved cases occur when incorrect or incomplete data are collected in either the census or in the sample survey being matched. It is also important that we have high interview rates in the PES. Non-response will invariably increase the percentage of unresolved cases.

We have been conducting research on an automated matching system for some time and have made significant progress. What makes it possible to use automated matching in the census are the automation advances we plan for the 1990 census--(1) an automated address control file, (2) early conversion of questionnaire data into computer-readable format, and (3) the key-entry of names for persons in PES blocks and nearby blocks. While the automated matcher may improve matching, there will still be cases that require clerical intervention and cases that we will not be able to match at all. We are aiming to reduce the percentage of these cases; however, this remains an area of concern.

We have been testing these and other improvements in our test censuses in 1985 in Tampa, Florida, and in 1986 in Central Los Angeles County and in East Central Mississippi.

We tested in our 1986 census in Los Angeles a variation to the PES. This variation involved enumerating the independent sample before the census, and so we call it a pre-enumeration survey. Matching and follow-up still occur after the census enumeration. We hoped that this method would allow an earlier start to the matching and could help us meet our timing goals; however, it is now uncertain that we would gain any time.

Demographic Analysis

The other principal coverage evaluation method I will mention is demographic analysis. Demographic analysis involves the development of an estimate of the population from administrative data records essentially independent of the census. The estimated population is then compared to the census count to measure coverage in the census. The sources used in demographic analysis include birth, death, and Medicare records, estimates of immigration, and estimates of emigration. Demographic analysis involves the comparison of aggregate data sets rather than case-by-case matching as in the PES.

Demographic analysis aims at providing national estimates of net census error for age, sex, and race groups. Since the 1950 census, demographic analysis has been the principal tool for estimating census coverage at the national level. The coverage figures I quoted earlier were based on demographic analysis. The technique does not allow the development of estimates for substate areas because the information on net migration is not sufficiently accurate. Demographic analysis also does not currently allow estimation of the coverage of Hispanics because many of the administrative records used to produce the estimates do not record whether a

person is Hispanic. (Many states now record whether a person is Hispanic on birth and other records, but demographic analysis requires using records, in some cases, going back 50 years or more.)

One principal difficulty facing the development of demographic analysis estimates for 1990 is the measurement of the undocumented alien population. Unfortunately, there is no widely accepted estimate of undocumented aliens in the country. Without an accurate estimate of this population, the estimate of the total population living in the United States may be subject to greater error than the level of undercount we are trying to measure.

We will develop demographic analysis estimates of the size and distribution of 1990 coverage errors at the national level. We plan to use them in conjunction with the results of the PES to measure coverage of the 1990 census.

Other Methodologies

We also have examined administrative records to determine whether they are a useful supplement to the PES. We have examined various kinds of lists--food stamps, driver's licenses, unemployment compensation, draft registration, Aid to Families with Dependent Children, and so on--to determine whether they contain large numbers of individuals from hard-to-count groups that tend to be missed in both the census and the PES. If we determine that the lists contain a large number of such individuals, they might be a useful supplement to the PES.

Another coverage measurement technique we have been investigating is called forward tracing. The Forward Trace Study is nearing completion. This method utilizes an independent sample drawn from the previous census, from birth and immigrant lists, and from lists of those persons missed in the previous census. These samples are traced forward in time (by keeping track of any new addresses to which persons move) to the current census, and the individuals are matched to the current census to determine their enumeration status. The preliminary findings from the study are that tracing is expensive and that there is a substantial residual group of untraced individuals, particularly among the demographic subpopulations that tend to be missed by a census. These results led us to the decision not to use this method for coverage evaluation for the 1990 census.

Another technique we investigated is systematic observation. We conducted some research in this area in the 1970's, and the Committee on National Statistics' Panel on Decennial Census Methodology recommended that we conduct research into systematic observation for 1990. Basically, systematic or "participant" observation involves a trained person living or working in a hard-to-enumerate area as a member of the community. The person, through observation or inquiry, can learn how many people live in a particular household and what their basic characteristics are. This observer's records can be matched to the census to come up with an estimate of census coverage. In the 1986 test census in Los Angeles, we have three anthropologists, each working in an area of about 2 city blocks. All have either lived in or have done extensive work for several years in the area they are observing.

In addition to enumerating their assigned area, the participant observers also are being asked to make suggestions, based on their experience, on how we can improve the PES interview methodology. It is doubtful that we could use systematic observation on a large scale in the census. We expect this study to be completed by the end of this year.

1987 Decision

In early 1987, we will decide on the statistical and operational feasibility of adjustment. This is not a decision about whether the adjusted numbers will be the official 1990 census counts. What appears feasible in 1987 may or may not be feasible in 1990. It will depend on the research and testing yet to be done and actual experience in the census.

In the course of our determination in 1987, we will examine field procedures in the 1985 and 1986 test censuses. We will review progress on the development of a fast and accurate automated matching system and other aspects of undercount measurement.

The date for this decision is driven essentially by the timing of our budget request for 1990. If we determine that adjustment is not technically feasible, then we would not go ahead with a full-scale adjustment program. We would likely propose a smaller, less costly undercount measurement program for the purposes of evaluation, but not adjustment.

If the decision is that we are statistically and operationally capable of adjustment, then we will plan work to permit adjustment unless the final results do not meet technical standards that we are currently developing. Although we cannot say definitively at this time what our determination will be, our research thus far on undercount measurement has been promising.

Adjustment for Small Areas and for Characteristics

The second issue is making adjustments for small areas and for demographic characteristics. To avoid inconsistencies in our tabulations and publications and confusion for our data users, we plan to adjust down to the block level and for as many characteristics as possible. Many important applications of census data, such as redistricting and fund allocation, use data for small areas. All the characteristics asked in the census have been included because they meet well demonstrated public needs or are required to fulfill legal mandates or implement governmental programs; thus, characteristics are important as well as total population and housing counts.

Our coverage measurement methodologies--whether case-by-case matching techniques or demographic analysis--would provide coverage estimates only for large geographic areas and broad demographic groups. To adjust the census, we would need a method or combination of methods to carry these estimates down to the local level and to adjust for characteristics. The adjustments would be based on statistical models rather than on direct estimates for each block.

In our research, we are evaluating several different approaches to carrying the adjustment down to these levels. These include synthetic, regression, Bayesian, and imputation techniques. We will test an adjustment methodology as part of the 1986 test census.

Standards for Adjustment

The third issue I will discuss is the standards for deciding whether it is statistically sound to adjust. We are developing and will announce well in advance of the census the standards we will use to assess whether the census counts or the adjusted figures are better. We want to reach a consensus among various stakeholders (Congress, the statistical community, etc.) in advance of the 1990 census on the criteria for judging the relative quality of the adjusted and unadjusted figures.

We are conducting research to develop these standards. A major goal of the research is to develop a conceptual framework to measure improvement in census counts. Another goal is to develop measures of the accuracy of the estimates of census coverage error.

We are developing standards for both methodologies of estimating census coverage error--the PES and demographic analysis. These two methodologies are very different and require different standards.

The standards upon which the adjustment decision is to be based must depend upon observable results of the census and of the coverage measurement studies. These would be such things as the measured differential census

undercount by race, ethnicity, or geographic level; indicators of the quality of the data collected in the coverage measurement survey; and indicators of the quality of the matching operation. The determination of how to weigh these observable results would be based upon conceptual measures of census data accuracy.

The standards will include an assessment of the quality of the data collected in the coverage measurement survey. The nonresponse rates for the survey will be one indicator of data quality; other indicators will be produced by the quality control operations. The consistency among a set of alternative estimates formed when the population is subdivided in different ways will provide an indication of whether the census and the survey were as independent as they were designed to be.

The quality of the matching operation is another area the standards must address. Indicators of the level of matching error will come from rematching a sample of the cases. The percentage of cases for which a determination of enumeration status could be made will also be an indicator of the level of error in the matching operation.

The standards concerning the quality of the data from the coverage measurement survey and the matching operation are designed to provide evidence that the assumptions underlying the methodology for estimating the census coverage error hold. Sampling error is also a measure of the quality of the survey data. We will combine the results concerning the quality of the survey and matching operations with the sampling error to obtain a

range of error about estimates of census coverage error.

The standards for demographic analysis must be based on indicators of the quality of the underlying data and the robustness of the results in light of possible variations in the assumptions. The data used in forming the demographic analysis estimates come from several sources. Some kinds of sensitivity analyses will be conducted. An example of such an analysis is an assessment of the sensitivity of the estimates of undocumented immigration to alternative assumptions concerning the level and nature of the misreporting of citizenship and country of birth in previous censuses.

A conceptual framework is required to deal with the likelihood that neither the census counts nor the adjusted data will be closer to the actual population for all areas or all groups. The conceptual framework would consist of quantitative measures of the improvement in census data. The measures of improvement will define whether adjusted or unadjusted data are, on balance, better.

One important issue we must address is how general or specific to make the standards. The standards need to be general enough to provide flexibility in interpreting and analyzing the data. However, if the standards are too general, they fail in their purpose of giving guidance to the decision process.

An example of a general standard might be: "The coverage measurement study needs to have a small nonresponse rate." A specific standard might

read: "The coverage measurement survey needs to have a nonresponse rate of less than x percent."

We continue to conduct research into census adjustment standards and plan to distribute the results of this research in the spring of 1987. After that, we will begin an intensive schedule of consultation with data users (including Federal agencies), professional statistical organizations, and the Congress.

Public Review

The fourth issue I will discuss is public review of our plans for adjustment. Public review of our plans for adjustment is an essential part of our planning process. We could not conduct the census without widespread support for our plans and goals. Neither can we contemplate adjustment--a complex enterprise in any case--without establishing a consensus of support (including Congressional review) for our techniques and standards.

We have consulted extensively with a wide range of interested individuals and groups. This hearing and the hearing before this Subcommittee 2 years ago are part of that process. We have discussed adjustment planning with professional associations, the Census Bureau's advisory committees, and at our annual research conferences. And we have benefited from the recommendations of the distinguished Panel on Decennial Census Methodology of the Committee on National Statistics in the National Academy of Sciences.

We have contracted with the Academy to convene a special panel meeting in the early fall of 1986 to advise on the development of adjustment-related programs. The Academy will present a summary of observations and recommendations to us in December 1986. These recommendations will help us develop the decennial census adjustment standards. To ensure continued participation by the Academy, we are negotiating for a 2-year extension of the existing contract. This contract extension will provide for on-site consultation with Census Bureau researchers to ensure an opportunity for the exchange of information on a schedule compatible with our commitment to critical milestone dates.

After the publication of our preliminary census adjustment standards early next year, we will hold a number of public forums to discuss the standards and other issues related to adjustment. These discussions will be at meetings of the census advisory committees, the annual research conference, and special meetings and workshops. In October 1987, we will publish the proposed standards in the Federal Register and review any comments we receive. In May 1988, we will submit materials on the proposed census adjustment standards for review by our Congressional oversight committees.

Decision on Adjustment

Finally, I will discuss the decision to adjust the census. Assuming that this process of assessing technical feasibility and submitting to congressional and public review results in a consensus supporting the Census Bureau's plans to adjust, the next question is: When do we decide to adjust and how do we make the decision?

There are two main parts to the overall decision process:

First, if the 1987 decision is that adjustment is statistically and operationally feasible, the machinery will be put in place. Coverage estimates will be made and population and housing estimates adjusted for an undercount will be produced. We have stated that we will only release the adjusted data if it can be shown that the adjustment figures are better than the unadjusted counts. The 1987 adjustment decision will essentially represent the Census Bureau's judgment, at that time, about whether to prepare adjusted estimates.

Second, in December 1990 or as soon as the coverage measurements have been obtained, we will evaluate the measurements in light of the specified technical standards. This evaluation will be looking for any substantial unforeseen errors that might have occurred or other unanticipated serious flaws in the coverage measurement process that would cause us to view the adjusted data as farther from the truth than the unadjusted data. Assuming the standards are met and such flaws have not occurred, we would release the adjusted data. But if our review indicates that serious errors occurred, then we would release the unadjusted data.

To make that decision, we will convene a group of key Census Bureau statisticians and demographers. In addition, we will refer this matter to the Committee on National Statistics' Panel on Decennial Census Methodology and to the Census Advisory Committee of the American Statistical Association. These outside experts will review the results of the census and the adjusted

figures and make comparisons with the established standards. They will make determinations and judgments about the accuracy of the undercount estimates. They will see if unforeseen errors occurred in the undercount measurement program that would cause us to view the undercount estimates as inaccurate and, therefore, not suitable for census adjustment. They will submit a report and recommendations to the internal technical group.

The internal technical group will consider the external experts' report and recommendations and will make recommendations to the Director of the Bureau of the Census. The Director will then make and issue the final decision.

The plan for determining whether to adjust has been designed to be independent of the judgment of only one individual. By developing standards that are agreed upon in advance, we are removing the need to trust the judgment of one specific person or any one concern. We believe that the decision must be based upon definite knowledge about the results of our coverage evaluation program and the quality of both the census and the evaluation. The key to this strategy is reaching consensus on the standards before the census is taken.

Conclusion

Mr. Chairman, that concludes my testimony on adjustment plans for the 1990 census. We are developing a dual strategy for the 1990 census: We will attempt to count everyone, and we will be prepared to adjust the census if we determine that adjustment will improve the counts.

I want to emphasize, Mr. Chairman, that the 1987 decision is a decision about what is statistically and operationally feasible, and should not be mistaken as a decision to adjust. What appears feasible in 1987 may or may not be feasible in 1990. It will depend on forthcoming research results, success in coverage improvement, and the results of coverage evaluation.

Adjustment is a highly complex and controversial subject. We are working on many technical issues that we must resolve before we can undertake adjustment. But we must also develop an approach to adjustment that will achieve widespread public support and understanding. Obviously, Congressional approval and support for our adjustment plans are crucial. We appreciate opportunities such as this to keep the Congress informed of our plans and look forward to discussing adjustment further as our plans develop.

Responses to Questions from
Subcommittee on Census and Population
to
Barbara Bailar
Associate Director
Statistical Standards and Methodology
on
the Adjustment Procedures and Coverage Evaluation
July 31, 1986

QUESTION 1. What makes you believe that the Bureau will have an easier time adjusting the census results in 1990? How does the situation we are likely to face in 1990 differ from the one that we faced in 1980?

ANSWER: I have no expectation that the Census Bureau will have an easy time adjusting the Census results in 1990. Coverage measurement is a complex, highly technical task. It is difficult under any circumstances, and will be no less so in 1990 than in 1980. Because of our research program, I do have increased expectations that the Bureau will be successful in adjusting the 1990 results. The 1980 census was not adjusted because the undercount estimates themselves were not good enough, whereas the research to date in preparation for 1990 leads me to have some confidence that the 1990 undercount estimates may be accurate enough to offer an improvement upon the unadjusted counts. We are planning for adjustment for the 1990 Census, whereas this planning was not done in preparation for the 1980 Census. A vigorous research program has been underway to develop improved methods of coverage measurement and improved methods for carrying down an adjustment to local levels. As I stated in my written testimony, progress thus far on most aspects of this research program has been promising.

QUESTION 2. In your testimony you give quite an important role to the National Academy of Sciences panel. At the same time, we have learned that there have been delays in funding their work. Could you tell us, when is the Bureau likely to make a decision about the future of the panel?

ANSWER: Our plans are to continue funding work by the panel through 1990.

QUESTION 3. What can you tell us about the results of your attempt to evaluate the census tests in Los Angeles and Mississippi?

ANSWER: The coverage evaluations in Los Angeles and Mississippi are proceeding well but are still at an early stage. The major field work in both locations was completed on August 1. Special followup efforts resulted in very few refusals, both in Los Angeles and in Mississippi. Computer matching of the test results to the corresponding census files is scheduled to begin in August. Final results from the Los Angeles and Mississippi evaluations will be available by the end of the calendar year.

QUESTION 4. What will be the anticipated cost estimate if the Bureau decides to go ahead with adjusting the census results?

ANSWER: The cost of a 1990 adjustment program will be higher than the \$17 million spent for the evaluation studies in 1980. Adjustment costs are contingent upon the methodology to be used in the original census enumeration. Until that methodology is clarified, and that will occur later this year, we cannot be specific about the cost estimates for coverage measurement and adjustment in 1990. I would observe, however, that adjustment brings three additional costs over 1980. One is a cost associated with the increased sample size required to achieve greater geographic detail in the coverage measurements, the second is the cost of carrying out a special Coverage Measurement Survey rather than piggybacking on an existing survey, and the third is the computer and clerical processing associated with an actual adjustment of the enumeration. In recent months we have reached a provisional estimate of the sample size required to support a census adjustment and that estimate is around 300,000 housing units. We will refine this estimate in the next year based upon information learned in the Los Angeles, Mississippi, and Tampa tests about the components of sampling error in a post enumeration survey.

QUESTION 5. If there will be no adjustment, what will be the sample size of the census evaluation and how much will the Bureau request the Congress for coverage evaluation?

ANSWER: If the Bureau decides in early 1987 that it is not technically feasible to adjust the 1990 census, we will limit our work to a coverage evaluation study. At this time we have not determined the goals for such a program or the methodology. As a rule of thumb, I expect the cost will be on the order of that in the 1980 Census carried forward to reflect inflation and various other structural changes in the population.

Mr. GARCIA. Dr. Fienberg.

STATEMENT OF STEPHEN E. FIENBERG, PH.D.

Mr. FIENBERG. Mr. Chairman, it is a pleasure for me to appear again before your subcommittee and to participate in this ongoing review of the Census Bureau's plans for 1990.

The Committee on National Statistics at the National Academy of Sciences has had special panel which has been examining the methodology in planning for 1990. And in addition to my own testimony, I have two other documents I would like to submit for the record: a statement by Prof. John Pratt, who is chair of our panel, and a summary of our panel's report which was coauthored by the panel study director, Dr. Constance Citro. She is present and prepared to answer questions that might be appropriate about the report and its recommendations.

Mr. GARCIA. Without objection.

Mr. FIENBERG. My own comments today are divided into three parts. The first part, briefly, deals with adjustment methodology, the second part addresses what our panel's suggestions and recommendations were, and the third part deals with the timing of decisions.

Let me begin by noting at the outset that I am an advocate of adjustment. I believe that the evidence marshaled by the Census Bureau's own studies of coverage in 1960, 1970, and 1980 amply demonstrate the existence of a substantial differential undercount, which for the black population in 1980 was about 5 percent nationwide. It is also important to recognize that a choice not to adjust the 1990 census would, in fact, be a choice of the method of adjustment, one which makes no change at all in the basic counts. In my view this choice would be the wrong one because I expect that there will be once again a differential undercount in 1990. Choosing a method that actually adjusts the counts makes more sense to me.

Adjustment aims, by supplementing the census counts with other information, to produce more accurate population estimates than the raw counts themselves. As Dr. Bailar has mentioned, there are two principal methods of adjustment that the Census Bureau has been pursuing, and the PEP method, primarily the one that is being focused on, is an approach which takes data from a second source—in this case it will be a large-scale survey—and compares the results of that source with the actual census results. The two sources are then combined and the count of those in both the census and the survey are used to estimate the number of individuals missed by both sources.

I am not going to try to describe in detail the methods to you, but I would simply like to note that they are well understood and that there is considerable agreement that they should serve as the basis for adjustment of raw census counts. There is still the need to sort out a variety of refinements and options within this methodology and to implement the techniques in the census context. This sorting out and implementation is a substantial undertaking and has been the focus of the activities of the Bureau.

The Panel on Decennial Census Methodology made a series of nine recommendations on adjustment, and they are listed in an appendix to my written testimony. The panel's view of the feasibility of adjustment for 1990 is captured by some excerpts from their report, which I have reproduced in my written testimony, and, in essence, what the panel is saying in those excerpts is that the Bureau's focus should be on the resolution of technical questions and the formal implementation of adjustment operations. The panel was focusing on the 1986 pretest at the time that report was written, and its intent was to allow for an early decision on adjustment, well in advance of the actual census.

In addition, the panel expressed concern that the Bureau might make a decision not to adjust until it had arrived at the best possible method, even though there might be a professional consensus that each of several methods would be superior to the use of the raw counts. As Voltaire once said, "the best is the enemy of the good," or as my colleague Herbert Simon would note, if a business was making this decision, it would not necessarily choose to optimize; rather, it would choose to "satisfice".

This process of census adjustment should be viewed as part of an overall program for coverage evaluation. Such a program provides valuable information for the users of census data and for the Bureau itself in its planning for subsequent censuses. Our panel recommended that coverage evaluation plans for 1990 be broader than those associated with this postenumeration survey methodology that is associated with adjustment.

When the panel reviewed the Census Bureau's work on adjustment, its work was really completed about a year ago, and neither the panel nor I have had an opportunity to make an indepth followup of the progress and planning that has occurred in the interim. It is my impression that the internal research program has not moved ahead at the pace that the panel had envisioned and that there hasn't been as vigorous a promotion of efforts in the adjustment area as the panel would have liked. In some ways my quick reading of Dr. Bailar's written testimony suggests that there has been more that has gone on at the Bureau than I am aware of, and I take great pleasure in that because I think adjustment-related research is crucial work.

The basic methodology for adjusting the census using data from a postenumeration survey program is, as I mentioned before, well developed and widely accepted. It is my belief that adequate procedures and agreed upon standards are available or could be developed in the near future to allow for an unambiguous decision about adjustment in advance of 1990. I would urge that closure on the details of the adjustment methodology be reached in the near future and that a full-scale test be made part of the census dress rehearsal. A final and reasoned decision could then be made well in advance of 1990 and the timetable suggested in Dr. Bailar's testimony fits well with the kind of timing and process that I envision.

Both the process for decisionmaking and the standards to be used require the outside scrutiny of professionals as well as comment from congressional oversight committees. Any timetable for decisionmaking should be designed to allow for this kind of input.

It has long been my personal view that the professional statistical community could agree on a process designed to reach a decision on whether or not to adjust the census data and on detailed adjustment methodology to be used in the event of a positive decision even though many individual statisticians have their own personal choices on how they would do adjustment. My personal choice would involve at least two pre-enumeration rather than post-enumeration surveys and something called multiple-capture methodology. But I would nonetheless be willing to agree to a process that virtually excluded this multiple-survey, multiple-recapture approach in order that there be a careful and fair evaluation of related methodologies for census adjustment.

The decisionmaking process relative to adjustment requires a dispassionate rounded discussion recognizing the full range and complexity of the technical issues. If these decisions are to be made in a timely and open fashion, the professional consensus on process could put the Census Bureau in what I would term a defensible position regarding the choice of methodology for 1990. Because litigation over adjustment is a drain on resources of everyone involved, congressional support for the census decision-making process is crucial.

I would like to just take a moment and read one of the final paragraphs in Professor Pratt's testimony because it relates to this issue, and I think it is quite relevant. His testimony reads:

The Census Bureau is politically neutral. They should be encouraged to do the best professional job they can, including obtaining timely outside input, with as little fear as possible of litigation or other such adverse fallout as long as they have proceeded professionally. One would not want their decisions about adjustment to be swayed by a feeling, for example, that a decision not to adjust may be easier to defend in court than a particular adjustment procedure that they would otherwise have chosen. If there are steps the Congress can devise to help the Bureau in this regard, I would strongly urge them.

Our panel was told something about the Australian method for certifying their census figures. It sounded marvelous, as if the Director of the Census Bureau delivered the figures to Congress and Congress immediately passed a law saying that these are the official figures to be used, and that was that. Maybe it is not that simple. Maybe a different approach would be more appropriate here in the United States and maybe nothing would work as well as the Australian method does there. But what would work best here is a matter for your professional judgment, and not ours.

The Committee on National Statistics and its Panel on Decennial Census Methodology stands ready to assist the Census Bureau and Congress in decisionmaking on the 1990 Census in the years to come. Thank you.

Mr. GARCIA. Thank you very much.

[The statements of Mr. Fienberg, Mr. John W. Pratt, and the summary referred to follow:]

July 24, 1986

STATEMENT
OF
STEPHEN E. FIENBERG
MAURICE FALK PROFESSOR OF STATISTICS AND SOCIAL SCIENCE AT
CARNEGIE MELLON UNIVERSITY
TO THE
SUBCOMMITTEE ON CENSUS AND POPULATION
OF THE
COMMITTEE ON POST OFFICE AND CIVIL SERVICE
U.S. HOUSE OF REPRESENTATIVES

Mr. Chairman, it is a pleasure for me to appear before your Subcommittee again, and to participate in your ongoing review of the Census Bureau's plans for the 1990 Decennial Census. I have been following this planning effort with great interest, in part because of my personal research activities, and in part through my position as Chairman of the Committee on National Statistics, at the National Academy of Sciences. The Committee has had a special panel, commissioned by the Bureau of the Census, which has been examining the methodological planning for 1990. The Panel issued a report last fall entitled: *The Bicentennial Census: New Directions for Methodology in 1990*, and several of the Panel's comments and recommendations are on the issue of adjustment, which is the focus of today's hearing.

In addition to my own testimony I have two other documents I would like to submit for the record, a summary of our Panel's report and a separate statement by Professor John W. Pratt, of the Graduate School of Business at Harvard University. Professor Pratt served as Chair of our Panel on Census Methodology and was unable to attend today's hearing. Dr. Constance F. Citro, the Panel's study director and the co-author of the summary, is present and is prepared to answer any questions you might have about the report and its recommendations.

My comments today are divided into three parts: the first part is a brief history of the capture-recapture technique which forms the cornerstone of most proposals for adjustment methodology; the second part addresses the Panel on Census Methodology's evaluation of approaches to adjustment and criteria to be used in

making a decision on whether or not to adjust; and the third part focusses on the timing of decisions on adjustment.

As a prelude to these comments let me note that I am an advocate of adjustment. I believe the evidence marshalled by the Census Bureau's own studies of coverage in 1960, 1970, and 1980 amply demonstrate the existence of a substantial differential undercount, which for the black population in 1980 was about 5 percent nationwide. It is also important to recognize that *a choice not to adjust the 1990 Census would be a choice of a method of adjustment*, one which made no change in the basic Census counts. In my view this choice would be the wrong one because I expect that there will be an undercount again in 1990. Choosing a method that actually adjusts the counts makes much more sense.

METHODOLOGY FOR ADJUSTMENT

Adjustment aims, by supplementing the census counts with other information, to produce more accurate population estimates than the raw counts themselves. Two principal methods of adjustment have been used by the Census Bureau in its own studies of undercount — the demographic method (which is applicable only at the national level and which requires estimates of the population of undocumented aliens) and the post-enumeration program (PEP) method (which is the primary approach that has been proposed for adjusting the 1990 Census).

The PEP approach takes data from a second source, such as the Current Population Survey, and compares this source with actual census results. The two sources are then combined and the count of those in both the census and the survey is used to estimate the number of individuals missed by both sources. The basic methodology for making such estimates usually goes under the label, *capture-recapture*, because of its original use in the study of biological populations, as long ago as 1895. Capture-recapture methods have been used in the study of human populations beginning in the 1940's, and much of it goes under the heading of dual system estimation. There is now an extensive literature on the topic which includes fine contributions by statistical researchers at the Census Bureau itself. In particular, I note the work of

Kirk Wolter on adapting the traditional approach to the sample survey setting, and the recent paper by Charles Cowan and Donald Malec on capture-recapture when both sources have clustered observations.

My purpose today is not to describe these methods for you, but to note that they are well understood and that there is considerable agreement that they should serve as the basis for adjustment of raw census counts. There is still the need to sort out various refinements and options within this methodology and to implement these techniques in the census context. This sorting out and implementation is a substantial undertaking and has been the focus of ongoing research activities at the Bureau.

RECOMMENDATIONS OF THE PANEL ON DECENNIAL CENSUS METHODOLOGY

It was against this background that the Panel on Decennial Census Methodology reviewed the Bureau's planning in the adjustment area. The nine recommendations on adjustment in Chapter 7 of the Panel's report (and listed at the end of this testimony) are focussed on adjustment to minimize differential coverage errors. As we review them today, it is important to remember that they were written in the spring of 1985. The Panel's view of the feasibility of adjustment in 1990 is well captured by the following excerpts from its comments:

Many technical questions remain to be answered if adjustment procedures are to be developed in time for their use in the 1990 census. On the whole, while much effort will be required, the panel is optimistic that substantial progress can be made, and many feel that this progress could well be sufficient to permit adjustment to become a feasible and desirable part of the 1990 census process.

We note that there are several different methods of adjustment that have been suggested so far, and we anticipate that others will be proposed. It is possible that a variety of alternatives, including compromise possibilities, will be developed with evidence that each would be an improvement over the census count, but with no obvious basis for choosing among them. In our view, this situation should not by itself preclude the Census Bureau from making adjustments and picking one of the alternatives.

In essence, the Panel noted that the focus of the Bureau's program in the adjustment area should be on the resolution of technical questions and the formal implementation of adjustment operations in a 1986 pretest to allow for an early

decision on adjustment, well in advance of the actual census in 1990. In addition, the Panel was concerned that the Census Bureau might make a decision not to adjust until it had arrived at the "best" method, even though there might be a consensus that each of several methods would be superior to the use of the raw census counts.

Census adjustment should be viewed as part of an overall program for coverage evaluation. Such a program provides valuable information for users of census data and for the Bureau itself in its planning of subsequent censuses. Despite the pressure from the outside to focus on adjustment-related methodology, the Census Bureau and Congress should not lose sight of the need for a well-conceived coverage evaluation program. The Panel also recommended that the coverage evaluation plans for 1990 be broader than those associated with the post-enumeration (or possibly pre-enumeration) survey methodology associated with adjustment. As I mentioned in my testimony before this Subcommittee in May, substantial effort needs to go into the planning for this program in order that the Bureau can adequately evaluate census coverage prior to the deadline for reporting apportionment figures in 1990.

THE TIME FRAME FOR DECISION-MAKING

The Panel's review of the Census Bureau's work on adjustment methodology was completed over a year ago, and neither the Panel nor I have had an opportunity to make an in-depth followup of the progress and planning that has occurred in the interim. It is my impression, however, that the internal Bureau research program has not moved ahead at the pace envisioned by the Panel and that the Bureau has not promoted and supported, vigorously enough, related statistical research in the academic statistical community on the technical problems involved in adjustment methodology. Moreover, the Bureau appears to have delayed the testing of alternative adjustment methods and deferred the timing of various decisions and choices.

A report prepared internally at the Census Bureau, subsequent to the completion of the Panel's first stage activities, suggested that a decision on whether to adjust be deferred until after all of the figures are available. In my view such a plan is sheer

folly, and is designed to ensure a last-minute decision not to adjust the raw counts. Equally unacceptable to me, and I suspect to the members of the Panel on Decennial Census Methodology, would be an early decision not to adjust because the Bureau is unable to decide upon and implement an operational adjustment procedure.

The basic methodology for adjusting the census using data from pre-enumeration or post-enumeration surveys is well-developed and widely-accepted. It is my belief that adequate procedures and agreed-upon standards are available or could be developed in the near future in order to allow for an unambiguous decision about adjustment in advance. I would urge that closure on the details of adjustment methodology be reached in the near future and that a full-scale test be conducted in conjunction with the census dress rehearsal. A final and reasoned decision could then be made well in advance of the 1990 Census. Both the process for decision making and the standards to be used require outside scrutiny and comment as well as congressional oversight and guidance. Any timetable for decision making should be designed to allow for this input.

It has long been my personal view that the professional statistical community could agree on a process designed to reach a decision (a) on whether or not to adjust the census data, and (b) on the detailed adjustment methodology to be used in the event of a positive decision, even though individual statisticians might differ in their personal choices. For example, my personal choices of methodology involve two or more pre-enumeration surveys and multiple-recapture methods for estimation. Nonetheless, I would be willing to agree to a process that virtually excluded the multiple-survey, multiple-recapture approach provided that a careful and fair evaluation of related methodologies were to occur.

The decision-making process relative to adjustment requires a dispassionate rounded discussion recognizing the full range and complexity of the technical issues. If these decisions are made in a timely and open fashion, the professional consensus on process could put the Census Bureau in a defensible position regarding the choice of methodology for 1990. Because litigation over adjustment is a drain on the

resources of everyone involved, congressional support for the census decision-making process is crucial. The Committee on National Statistics and its Panel on Decennial Census Methodology stand ready to assist the Census Bureau and Congress in this decision-making process in the coming years.

APPENDIX: RECOMMENDATIONS OF THE PANEL ON DECENNIAL CENSUS METHODOLOGY REGARDING ADJUSTMENT OF CENSUS DATA

Recommendation 7.1. Completeness of the count is an important goal, both for ensuring the accuracy of the census and for establishing the credibility of the census figures among all users. Adjustment should not be viewed as an alternative to obtaining as complete a count as possible through cost-effective means. Nevertheless, the ultimate goal is that of the accuracy of the published figures. Given the likelihood that the census will continue to produce different rates of undercoverage for various population groups, and given the equity problems caused thereby, we recommend that work proceed on the development of adjustment procedures and that adjustment be implemented if there is reasonable confidence that it will reduce differential coverage errors.

Recommendation 7.2. In measuring the total loss associated with an adjustment procedure, we recommend that the contribution to this loss attributable to a geographic region should reflect its population size. Thus, we recommend against loss functions based solely on the number of political entities losing or gaining through adjustment.

Recommendation 7.3. We believe that, in general, the results of an adjustment are likely to be affected more by the quality of coverage evaluation data and the models and methodology used than by the choice of loss functions. Given a family of loss functions with relatively similar objectives, it should be possible, and desirable, to determine an adjustment procedure that has good performance for most or all of them. We recommend that the Census Bureau investigate the construction of adjustment procedures that are robust to a reasonable range of loss functions.

Recommendation 7.4. We recommend that the Census Bureau explore methods for

providing estimates of errors associated with estimates of census over- and undercoverage, with a view to publishing such error estimates along with coverage evaluation results and any adjusted census data that may be issued.

Recommendation 7.5. The panel believes that it is important to strive for internal consistency of published census figures. Should adjustment appear feasible and effective, methods exist for distributing adjusted totals for aggregated groups down to subgroup values. We recommend that one of these methods be used to achieve internal consistency of census figures.

Recommendation 7.6. Census data used for reapportionment and redistricting are required by law to be produced no later than specific dates. It is possible that adjustment of the 1990 census will prove feasible and effective in all respects, except for the ability to meet the required deadlines. This should not necessarily preclude subsequent issuance of adjusted data for other uses. In this situation, we recommend that the Census Bureau seek determination by Congress of whether it desires that adjusted data be used and will therefore extend the deadlines, or wishes to adhere to current deadlines and will therefore stipulate the use of unadjusted (or partially adjusted) data for reapportionment and redistricting.

Recommendation 7.7. The panel recognizes that considerable work is still necessary and likely to lead to improved procedures for adjusting census data. We therefore support the Census Bureau's stated plans to pursue, internally, research and development of adjustment procedures, and we also recommend that the Census Bureau vigorously promote and support related statistical research in the academic community.

Recommendation 7.8. The panel supports the Census Bureau in its plans for a 1986 pretest of adjustment operations, including the production of mock tabulations of adjusted census data. We recommend analysis of the resulting adjusted and unadjusted data sets, to help identify the strengths and weaknesses of the particular methods tried.

Recommendation 7.9. We recommend that research on adjustment include: (1) investigations of the assumptions underlying the procedures, (2) an attempt to evaluate empirically the more important of the assumptions as well as the sensitivity of methods to violation of assumptions, (3) study of methods used for carrying down estimates to lower levels of aggregation, and (4) a study of the impact of adjustment on uses of census data.

July 24, 1986

STATEMENT
OF
JOHN W. PRATT
PROFESSOR OF BUSINESS ADMINISTRATION
HARVARD UNIVERSITY
TO THE
SUBCOMMITTEE ON CENSUS AND POPULATION
OF THE
COMMITTEE ON POST OFFICE AND CIVIL SERVICE
U. S. HOUSE OF REPRESENTATIVES

I am sorry not to be present in person. The problem under discussion -- adjusting the Decennial Census -- is extremely important and difficult. This was a major reason for the commissioning of a National Research Council panel and for my willingness to chair it as a nonparticipant in the debate and litigation. I certainly support all we said in our report, and would personally perhaps emphasize even more pressing on with the research and development work needed before an acceptable adjustment. I have read Professor Fienberg's statement of July 24 and concur with its thrust over all. Regarding the chance of being ready to carry out an adjustment in 1990 if we really try, I would be more optimistic than the report sounds, but not quite as optimistic as Professor Fienberg's statement sounds. I would like to make a few comments, which may add something to these documents, but will not be as well organized as either of them -- as may already be evident.

Adjusting Decennial Census data, especially for undercount, is a large and complex problem. Vast funding and planning efforts are significantly affected by the adjustment chosen, which is inevitably an estimate, be the estimate 0 or the simplest kind of "capture-recapture" ratio adjustment or the result of an elaborate procedure based on a model of how the probability of being missed relates to the characteristics of individuals

or groups. So much hangs on the numbers that the discussions among statistical experts about the choice of procedure in 1980 seem to have been displaced largely to the courts, an extremely cumbersome, expensive, divisive, and inappropriate forum for what ought to be an open, friendly, professional exchange of technical judgments without political or legal overtones.

Another reason the discussion went to the courts is that it is hard, even for professionals, to recognize and face up to the fact that a "complete" count needs adjustment, and hard to face up to explaining it to the public. It may seem trivial to count people, but it isn't. You want to include small children, travelers, students away from home, street people, drifters, and illegal aliens; people in hospitals, nursing homes, mental or penal institutions, military service, vacation homes, and hotels; people on welfare who fear their payments may be affected; and so on. You want to count them once and once only, in the correct household and location, with correct characteristics. Some people are answering for others, with possible errors and duplication. In fact, once you start to think about doing a Census in the field, from Bedford-Stuyvesant to Berkeley, with a nationwide field staff recruited for a few months' work every ten years, you have no trouble realizing how difficult it is, and how impossible to make it perfect, even if resources were much larger than they are.

The Census Bureau has set very high standards, and has been quite remarkable in its willingness to evaluate its own work and its honesty in doing so. Its own evaluations were the main source of information on the undercount in 1980. Perhaps the Bureau would have avoided much heat, stress, and time in court if it had never done anything to evaluate its own work. It is important that it have the encouragement, mandate, and resources to carry out evaluations in the future, both the gathering and the analysis

of evaluation data. In particular, the natural tendency to shortchange analysis under pressure of new business and budgetary stringency needs to be resisted.

Adjustment and evaluation have much in common intellectually, but neither is a substitute for the other operationally. Adjustment calls for an entirely different scale, detail, and timing. One approach is to trace people forward from the previous Decennial Census, subtract deaths and emigration, add births and immigration, and compare the result to the current Decennial Census. In the United States a satisfactory adjustment procedure cannot be arrived at this way, because of our great mobility, lack of emigration records, inadequate records on legal immigration, illegal immigration, and so forth.

Another thought is to do a perfect census in a sample of places and infer the correction needed elsewhere. But the best judgment of those who know is that even the best staff in a sample of places cannot achieve perfection. Furthermore, the inferential problem is not much easier or freer of assumptions than for capture-recapture methods. In fact if the sample is taken separately from the census it is just the extreme case of perfect recapture, while a sample of places treated differently within the census would provide very weak information for correcting the standardly enumerated places.

Imagine you did the whole census twice and discovered which people were counted ("captured") both times, which were counted the first time but not the second, and which were counted the second time but not the first. You want to estimate the number of people not counted either time, and the age, sex, race, location, etc., of each. If everyone had the same chance of being missed in a census, it would be simple: the chance could be estimated (very accurately if the census is large) by the fraction of people

counted in the first census but missed in the second (or, for that matter, by the fraction counted in the second but missed in the first). Knowing this chance, one would know how many people there are altogether compared to the number counted.

Of course the chance of being missed is different for different types of people -- that is what the differential undercount is. What the chance is in different groups can be estimated by looking at each group separately. But if the groups are too small, the estimates will not be very accurate. So the undercount of black male centenarians in Berkeley will be hard to estimate. And since we cannot afford two censuses, one must be replaced by a sample. This means that many categories of interest will be too small to look at individually, and we will have to make use of collateral information to estimate the undercount in each category. This requires some assumptions about what collateral information is relevant to each category, and how it relates. The assumptions will be implicit if not explicit, and partly but not totally checkable. And there are trade-offs between improved accuracy if assumptions are correct and inaccuracy if they are not. So now it is getting complicated and it is time to leave it to the experts.

All methods depend on matching -- determining whether someone listed on one occasion was also listed on another, despite possible variations in name, location, and characteristics and lengthy lists. Estimating and allowing for the inevitable imperfection in matching is another complicated subject for the experts.

So adjustment requires a lot of difficult work, it can't be done perfectly, and it depends on expert judgment. But the census is a lot of work and can't be done perfectly. And one judgment that seems clear to me

is that an unadjusted census is not the best we can do if we are willing to devote adequate resources to adjustment. There will always be some adjustment procedures that are worse than nothing, and the best adjustment can never be determined unequivocally, but there must be some procedures that are better than nothing, and we should be able to develop and assent to one.

This brings me back to the problem of litigation over the Census. It is my impression that many of the Census Bureau's best people spent major parts of their time for several years dealing with suits and threatened suits over the 1980 census, at great cost to other activities. There must have been a similar cost to some of the governmental units bringing suit, and substantial court and legal costs. While some of the professional discussion engendered was useful, this is the most inefficient way to engender it that I can imagine, and the adversarial atmosphere seriously slows, hampers, and distorts it besides, I believe.

The Census Bureau is politically neutral. They should be encouraged to do the best professional job they can, including obtaining timely outside input, with as little fear as possible of litigation or other such adverse fallout as long as they have proceeded professionally. One would not want their decisions about adjustment to be swayed by a feeling, for example, that a decision not to adjust may be easier to defend in court than a particular adjustment procedure they would otherwise have chosen. If there are steps the Congress can devise to help the Bureau in this regard, I would strongly urge them.

Our panel was told something about the Australian method of certifying their census figures. It sounded marvelous -- as if the Director of the Census Bureau delivered the figures to Congress, Congress immediately passed a law saying that these are the official figures that will be used, and that was that. Maybe it is not that simple, maybe a different approach would be more appropriate here in the United States, and maybe nothing would work as well here as the Australian method does there. But what would work best here is a matter for your professional judgment, not mine.

I am grateful for the opportunity to present this statement.

**The Bicentennial Census:
New Directions for Methodology in 1990**

Summary

John W. Pratt and Constance F. Citro

March 1986

This summary represents an abridged and reorganized version of Chapter 1 of the report of the Panel on Decennial Census Methodology, *The Bicentennial Census: New Directions for Methodology in 1990* (Constance F. Citro and Michael L. Cohen, eds., Washington, D.C.: National Academy Press, 1985). The authors wish to acknowledge the vital contributions to the report of the members of the panel and of Michael L. Cohen, who served as research associate for the panel. The project was supported by funds from the Bureau of the Census, U.S. Department of Commerce.

PANEL ON DECENNIAL CENSUS METHODOLOGY

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1. Introduction

The Panel on Decennial Census Methodology of the U.S. Committee on National Statistics recently completed a review of census practices and procedures in the United States and made a series of recommendations directed to the planning of the nation's bicentennial census in 1990. As charged by its sponsor, the U.S. Census Bureau, the panel investigated several new directions for census methodology to address the growing challenge posed by societal needs for small-area data that meet high standards of quality yet are produced at reasonable cost. In this paper we summarize the panel's thinking and recommendations in its report, *The Bicentennial Census: New Directions for Methodology in 1990* (Citro and Cohen, 1985). These recommendations are timely because the U.S. Census Bureau has under way an extensive program of research and testing for the 1990 census.

2. Census-Taking in the United States of America

Periodic censuses of population are a long-established tradition in the U.S., with roots going back to the earliest years of the colonial period. The royal colony of Virginia conducted the first census in North America in the early seventeenth century, and censuses of individual colonies were frequently attempted during the colonial era (U.S. Bureau of the Census, 1970, p. 3).

Political necessity led to the requirement for a periodic complete enumeration of the population in the new nation formed after the American Revolution. In the compromise between large and small states made at the 1787 Constitutional Convention, the delegates voted to provide equal representation for each state in the Senate and representation proportional to population in the House of Representatives; the population of each state was to be determined through a decennial census. Article 1, section 2, of the Constitution stipulates:

Representatives and direct Taxes shall be apportioned among the several States which may be included within this Union, according to their respective Numbers. . . . The actual Enumeration shall be made within three Years after the first Meeting of the Congress of the United States, and within every subsequent Term of ten Years, in such Manner as they shall by Law direct.

Although fundamental issues of the structure of government provided the motivation for the U.S. decennial census, the country's leaders recognized from the beginning that the census could be a valuable source of information for many other purposes. James Madison noted in 1789 (U.S. Bureau of the Census, 1970, p. 4) that Congress:

had now an opportunity of obtaining the most useful information for those who should hereafter be called upon to legislate for their country, if this bill was extended to embrace some other objects besides the bare enumeration of the inhabitants; it would enable them to adapt the public measures to the particular circumstances of the community.

The first census in 1790 asked the age, sex, and race of each resident. During the next 100 years, the census became firmly established as an important information resource. The centennial census in 1890 asked questions on more subjects than any census before or since, including 30 items on the basic population questionnaire, several housing questions, and special inquiries about decedents, inmates of almshouses and prisons, Indians on and off reservations, Civil War veterans and widows of veterans,

and several categories of mentally and physically disabled people (U.S. Bureau of the Census, 1973, pp. 74-91).

Work is now under way to plan for the nation's bicentennial census of population and housing, scheduled to take place on April 1, 1990. Reflecting a long-standing tradition of improvement and modification to meet changing information needs and to take advantage of technological advances, census-taking in the twentieth century has come to differ in many important respects from census-taking in the nineteenth century. Some features that have been introduced into modern U.S. censuses and will undoubtedly continue in 1990 are:

- o Since 1910, the census has been directed by a permanent organization, the U.S. Bureau of the Census, with an experienced, professional staff in charge of planning and supervising the operation.
- o Since 1940, statistical sampling methods have been used to obtain responses to many census items, so that a large volume of useful information can be gathered without placing the burden on every household of responding to all questions (the 1980 census asked 7 population and 12 housing items of all households, while about 20 percent of households were asked so additional 26 population and 20 housing questions).
- o Since 1970, the U.S. Postal Service has delivered most of the census questionnaires, and households asked to mail their completed questionnaires to census offices. Enumerators telephone or visit only those households that do not completely respond (95 percent of households were sent questionnaires by mail in 1980 and 83 percent of them returned their questionnaires by mail).
- o Since 1960, large computers have been used to process the census returns in a relatively short span of time; in contrast, the 1890 census required almost a full decade to process, even with the introduction of punchcard machines to help the clerical work force.
- o Since 1950, intensive effort has been devoted to evaluating the completeness of coverage of the total population and of important subgroups and geographic areas.

Undoubtedly the 1990 census will also differ from the most recent censuses in the United States. Most of the differences are likely to represent incremental improvements and modifications to tried and tested procedures: for example, mailout-mailback techniques may be extended to the remaining 5 percent of the population residing in sparsely settled rural areas that enumerators personally canvassed in 1980. But pressures are growing in this country, as in other Western nations, to address the problems of rising costs of traditional census practices on one hand and to satisfy expressed needs for greater accuracy in the numbers on the other. Consequently, exploration of changes in methods and techniques that mark a greater break with tradition is under way: for example, one proposal that has received much attention is the use of statistical techniques to adjust the field counts for deficiencies in the enumeration.

Major changes in census methodology, such as the use of sampling for content and mailout-mailback enumeration, have often been made on a small scale in one census and then more fully implemented in the next. The 1990 census will be part of a continuing evolution that may lead to a methodology in the twenty-first century that differs as significantly from current methodology as current methodology differs from that of the nineteenth century.

3. The Planning Cycle for 1990

Planning for the 1990 census officially began in fall 1983 with an appropriation for fiscal 1984. Well before that date, however, substantial work of direct relevance for 1990 was conducted. The 1980 decennial program included several experiments and post-enumeration studies designed to help plan improvements in methodology for subsequent censuses. Pretests carried out in the late 1970s of concepts and procedures considered for 1980 also had results that are useful for 1990 census planning.

To the general public and many casual users of census data, it may appear that the Census Bureau has ample time to plan wisely for the 1990 census, given the start of the planning process more than six years prior to Census Day, April 1, 1990, and the foundation of research already completed in connection with prior censuses. In fact, as a review of the Census Bureau's field test schedule for 1990 indicates, there are relatively few opportunities to test thoroughly changes or modifications in census procedures, particularly if the changes represent major departures from the past. Moreover, evaluation of the likely impact of important changes is hampered by the fact that pretests cannot adequately assess the effects of alternative procedures on public cooperation with the census--only tests conducted under census conditions, that is, experiments incorporated into an actual census as distinct from pretests, can fully address this important question.

The Census Bureau's 1990 census testing program began in spring 1984 with tests of mailing list compilation methods in several localities around the country (U.S. Bureau of the Census, 1984). Two large-scale pretests were fielded in spring 1985. Pretests will also be conducted in 1986 and 1987. Finally, the research and testing program will culminate in 1988 in "dress rehearsals" of the procedures planned for 1990. This schedule not only compresses into a few years the opportunities to test new methodology but also compresses the time available to evaluate the results from one test and incorporate them into the design of the next.

In addition to the compressed time schedule for testing and research, two other critical factors affect the ability of the Census Bureau to modify census methodology: staff and budget resources. The Census Bureau has long been known for the high quality and dedication of its technical staff. The current budget for research on decennial census methodology, particularly for research on the undercount, is large by the standards of earlier censuses. Nevertheless, no agency of government, particularly in the constrained world of the 1980s, can expect to have sufficient staff or resources to try out more than a few promising ideas and concepts. Pressures in the next few years to reduce the federal government's large deficit may make it more than usually difficult to obtain adequate staff and funding to carry out a thorough research and testing program for 1990. Hence, it is critical to designing the best census for 1990 and to being in the best position to plan further design changes for 2000 that the Census Bureau make the most of the testing opportunities afforded over the next few years and establish priorities for testing and research wisely.

4. The Importance of Choice of Methodology for 1990

Controversy surrounding population censuses has as long a history in the United States as census-taking itself. According to one review (Bureau of the Census, 1982a, App.IIIb, p. 73), censuses conducted during the colonial period, generally at the direction of the Privy Council or the British Board of Trade, "were seldom regarded as complete or successful, as people perceived them being for the purposes of taxation or conscription and were evasive and uncooperative." The decennial censuses conducted in the new nation had a constitutional mandate according them legitimacy and support. Moreover, Conk (1983, p. 7) has noted that: "After the first few censuses, Americans

became increasingly interested in the census results . . . [which] showed that the population was growing steadily and extremely rapidly." It quickly became evident in the early nineteenth century, however, that not all areas were sharing equally in population growth and that reapportionment based on census results meant substantial shifts in political power. Conk (1983, p.8) continues:

It is not surprising therefore that nineteenth century Americans who were pleased with the overall thrust of population change claimed that the census proved the virtue of the American way of life or the American system of government. Conversely, those who felt shortchanged by reapportionment or were concerned about the tendencies of population change challenged both the census and the apportionment system.

The first extensive criticism of the census by statisticians occurred in 1843 when the American Statistical Association (ASA) issued a lengthy report that documented glaring errors in the data on education, occupation, and especially the classification by race of persons identified as insane, idiotic, and deaf and dumb. The ASA recommended that these results should be corrected or, at the least, disavowed. Problems with both undercount and fraudulent additions to the count were documented in many early censuses (U.S. Bureau of the Census, 1982a, App.IIIb, pp. 81-83).

Congress did not as a general rule respond directly to these criticisms, although occasionally it acted to alter the apportionment of the House when there was strong evidence of gross deficiencies in the population count. Congress gave a third representative to Alabama in 1823 when the claim was made that the 1820 census omitted two counties and in 1860 awarded an additional seat to California because of problems with the census in that state (U.S. Bureau of the Census, 1982a, App.IIIb, p. 82). These actions were politically much more palatable than similar actions would be today, because reapportionment legislation up through 1910 added representatives to accommodate population growth rather than allocating a fixed number of seats among the states.

Despite the questions raised about the population enumeration in the past, a review of decennial census history suggests that social and political forces have converged in recent years to make the census in this country--and in other countries as well--a matter of demonstrably greater controversy than before. Several factors are involved.

On one hand lie increased concern with the need to protect the privacy of individual citizens and a sense that the public is oversurveyed and less willing to respond to government inquiries. Indeed, in the last few years, the level of public suspicion and hostility to plans for the census caused the governments of several Western European countries to delay their census programs or cancel them entirely (see Butz, 1984; Redfem, 1983).

On the other hand, legislators have increasingly turned to statistics in making tough policy decisions. In fiscal 1984, federal grant-in-aid programs allocated at least \$80 billion to states and localities via formulas that depended in important ways on census figures (or statistics based on census figures, such as current population estimates) to determine which areas received how many dollars (U.S. Office of Management and Budget, 1985). As noted above, census data are used by constitutional mandate to determine the number of seats in the U.S. House of Representatives that are allotted to each state. They are used as well in drawing up congressional and state and local legislative districts to meet rigid criteria for equitable representation of the population. Data requirements for redistricting purposes in 1980 included census tabulations of the population by race and Hispanic origin for each of several million city blocks in urban parts of the country and enumeration districts in unblocked areas (U.S. Bureau of the Census, 1982b, p. 79).

In addition to these critical governmental needs, census data support many other major uses. Data from the latest census serve to document the social and economic condition of the country as a whole and are the single most important source of information for small areas and groups in the population. Comparative information from successive censuses illuminates trends over time. Researchers, planners, and decision makers in business, government, and academic institutions make use of census data for a wide range of important planning and analysis purposes. Just a few of the many uses to which census data are put include:

- o Site selection for public service facilities and commercial establishments based on evaluating the socioeconomic characteristics of alternative locations;
- o Transportation planning using detailed data on commuting flows; and
- o Research into changing rates of population growth for metropolitan versus nonmetropolitan areas and different regions of the country.

Many analyses based on census data have implications for the distribution of political power and wealth among various population groups in the country. For example, census data on the racial, ethnic, age, and sex makeup of occupational groups in labor market areas are used to assess the extent to which work forces reflect the characteristics of the local labor force. These data frequently form the basis of antidiscrimination lawsuits brought against employers. Census data on the makeup of the local population are used to assess--and challenge--the representativeness of grand and petit juries. Census data on earnings cross-tabulated by various characteristics are used to analyze wage disparities within and among occupations and important population subgroups. Findings from such studies can affect outcomes of public policy deliberations, such as the current debate over the issue of comparable pay for jobs of comparable worth. All of these uses have underscored more than ever before the importance of obtaining a complete and accurate count of the population as well as accurate data about characteristics.

Yet to obtain highly accurate data costs money. The 1980 census cost close to \$1.1 billion dollars--about \$4.75 for each inhabitant of the United States (U.S. Bureau of the Census, 1983, p. 88). The per capita amount is small compared with the per case cost of most government and private-sector sample surveys. Moreover, this total cost includes planning, collection, and processing activities that spanned most of a decade and provided data that are of value for the decade and beyond. Nonetheless, census costs exceeding \$1 billion excite comment and invite close scrutiny to determine how they might be reduced. Recently in Canada, the quinquennial census scheduled for 1986 was cancelled because of budget constraints facing the government; it was subsequently reinstated, however, in response to widespread public expressions of concern and its demonstrated cost-effectiveness compared with alternatives. The U.S. decennial census is constitutionally mandated; nevertheless, pressures are likely to be severe in the coming years to attempt drastic cost reductions both in census planning activities and in the enumeration, despite the fact that, compared with other ways of obtaining comparable information, the census is still cost-effective.

The Census Bureau's own research has shown that there were inaccuracies in the 1980 census, both of underenumeration (that is, persons who were missed) and overenumeration (that is, persons who were inadvertently counted twice or otherwise included when they should not have been). Evaluation studies generally point to the conclusion that the 1980 census produced a small net undercount of the total population--that is, the census count, including erroneous enumerations, fell somewhat short compared with an independent demographic estimate. Most significantly, important race, sex, and age subgroups of the population experienced differential rates of net undercount. There is

strong evidence that the black population experienced a net undercount of about 5 percent nationwide. Black men ages 25-54 appear to have had the highest net undercount rates—close to 15 percent on average (Passel and Robinson, 1984, Table 3). Coverage estimates for whites and other races are difficult to derive because of the lack of reliable estimates of net legal and illegal immigration. Making a range of reasonable assumptions about the size of the illegal alien population, it appears very likely that whites and other races experienced net undercount in the 1980 census, but that the rate of undercount was smaller, perhaps significantly smaller than the 1.5 percent rate estimated for 1970 (see Passel et al., 1982, pp. 6-8).

Differential net undercount means possible inequities in redistricting, fund allocation, and provision of social services based on census data as well as possibly erroneous conclusions drawn from studies used as the basis for antidiscrimination policies and lawsuits and other socially important purposes. The belief that errors in the census affected representation and fund allocation gave rise to an unprecedented number of lawsuits following the 1980 census. By October 1981, over 50 suits had been filed challenging the census results (U.S. Bureau of the Census, 1983, p. 85). Currently, the judge assigned to a major case in which the State and the City of New York are suing to have the Census Bureau adjust the 1980 census counts is reviewing testimony and preparing to hand down a decision; 23 other cases are awaiting settlement of the New York suit. Analyses by Kadane (1984) and Gilford (1983) indicate that the apportionment of congressional seats may have been affected by the differential undercount. For example, Kadane found that if one of the sets of estimates produced from the 1980 Post-Enumeration Program evaluation were used to adjust the census results, California would have received an additional seat at the expense of Pennsylvania.

5. Proposed Changes In Methodology

Not surprisingly, many ideas have been proposed by the Census Bureau and others to improve the decennial census. Some are directed principally at improving coverage and reducing differential coverage errors. One idea in this class is to match administrative records, such as driver's license lists and other sources, against the census on a scale even larger than that used in 1980 to identify people who should be followed up to determine if they were improperly omitted from the census count. Other ideas are directed principally at reducing costs. One such approach is to make use of sampling, not only to obtain information on characteristics, as is currently standard decennial census practice, but also as part of the procedure to obtain the count. For example, one could attempt contact with a sample of households that do not mail back their questionnaires, rather than all nonrespondents, in the follow-up stage of census operations. Special coverage improvement procedures could also be carried out on a sample basis.

Two important themes stand out in current discussions of methodology for the decennial census. One relates to the degree of emphasis that should be given to counting versus estimation. A census, no matter how diligently administered, can never be complete or without error. Moreover, in current census methodology, not every record corresponds to a person actually named on a questionnaire; for example, some records (about 1 percent in recent censuses) represent imputations in situations in which there is good evidence that a housing unit is occupied but repeated efforts have failed to find the residents. Hence, a census, strictly speaking, provides an estimate of the population.

From this recognition has come a view of the decennial process that emphasizes estimation and argues that some of the resources for conducting the census should be shifted from traditional coverage improvement procedures to developing the best possible estimates of the total population and subgroups. Input to the decennial year

population estimates, in one version of this view (Ericksen and Kadane, 1985), would include not only a well-conducted census, but also information obtained from various programs conducted on a sample basis that would provide a basis for adjusting the census field counts. (Such programs might include matching of samples of administrative lists to census records and follow-up of a sample of households that did not respond to an initial follow-up effort.) Whatever the degree of emphasis placed on estimation, the known errors and the incompleteness of the census count mean that the issue of adjusting census figures needs to be addressed.

The other theme relates to the critical importance of evaluation programs in the methodology of the decennial census. Politicians, policy analysts, statisticians, economists, demographers, other social scientists, and users of census data in all sectors have expressed divergent views regarding the most appropriate methodology for conducting the census. But however they view the census, there is substantial agreement on the importance of evaluating the completeness and accuracy of census statistics.

The Census Bureau has conducted formal evaluation programs for every census since 1950 (U.S. Bureau of the Census, no date). All of the techniques used to date in this country and abroad, including demographic analysis, reverse record checks, administrative record matches, and post-enumeration surveys (whether recanvassing selected areas or matching independent surveys to census records), have important flaws. In the United States today, the absence of adequate data for estimating net immigration, whether of legal or illegal residents (Marks, 1980), poses particularly severe problems for evaluating the census count even at the national level using the demographic method. Furthermore, if evaluation results were to be used for census adjustment purposes, then reasonably accurate information on the errors of evaluation estimates would also be needed. Nevertheless, with concern over possible inequities in political representation and the distribution of large amounts of federal dollars as well as concern over the adequacy of the data for analysis of the socioeconomic status of important population groups, there has never been a greater need for thorough evaluation of the decennial census. This evaluation is necessary whether the object is to inform users of known errors in the census or actually to adjust census results.

While there is widespread agreement that evaluation is important and that the issue of adjustment must be faced, many decisions on methodology for 1990 remain to be made. It is clear that there is no lack of ideas and suggestions that appear useful to investigate. It is also clear that the process of determining a reasonable methodology for 1990 will involve difficult choices. The Census Bureau has stated (Bailar, 1984, p. 259) that its minimum goals for 1990 are to:

- (a) Conduct the 1990 Census without increasing the per-housing-unit cost in 1980 dollars. (b) Expedite the availability of the data to users. (c) Maintain a high rate of overall coverage and improve the accuracy of small area data while reducing the overall differential for population groups and geographic areas.*

It may be possible to design a methodology that makes gains in the desired direction on each of these dimensions. The more likely situation is that it will be possible to make progress on one or two dimensions but at the price of giving up improvements on the others. Explicit trade-offs reflecting costs and benefits will need to be made in the choice of methodology for 1990 and beyond (see Keyfitz, 1979). Because the high costs of censuses and the compressed time frame within which they are carried out make mid-course corrections impossible, it is essential that the methodology to be used be thoroughly tested.

6. Independent Reviews of Decennial Census Plans

The Census Bureau is actively working on methodology for the 1990 census and has assembled staffs to plan the census and specifically to work on issues of undercount and the possible adjustment of census counts. For many decades, the Census Bureau has also actively sought outside independent review of its plans and proposed procedures. In addition to ongoing advisory committees involving various professional disciplines and advisory committees representing the interests of population groups for whom census results are particularly important, the Census Bureau has asked the National Research Council (NRC) and the American Statistical Association (ASA) to conduct special studies of the decennial census. The report of the Panel on Decennial Census Methodology represents the fourth outside review conducted in recent years of key aspects of modern census methodology. A brief discussion of the scope and thrust of the predecessor NRC and ASA studies can help place this latest study in context.

6.1 The 1969-1972 NRC Advisory Committee on Problems of Census Enumeration

The Census Bureau sponsored a study in 1969 by a committee of the National Research Council to provide advice on ways to improve completeness of coverage in the decennial census and intercensal household surveys. (The U.S. Office of Economic Opportunity and the Manpower Administration of the U.S. Department of Labor also contributed support for the study.) The Advisory Committee on Problems of Census Enumeration issued its final report, *America's Uncounted People*, in 1972. The report focused on the need to understand the social and psychological context in which undercount occurs. For example, the committee noted that people may be missed in central city areas because, although members of extended families, they are not attached to a family or household residence, which is the basic unit of enumeration in the census and household surveys. The committee strongly recommended that the Census Bureau broaden its research strategy and knowledge base to include methods and concepts not typically embraced in survey research. The report included specific recommendations to conduct experimental studies of questionnaire wordings and formats and their effects on respondents; explore the utility of communication research for better understanding the reasons for census and survey undercoverage; and carry out localized participant-observer studies to learn more about the impediments to census data collection in different kinds of areas.

6.2 The 1978 NRC Panel on Decennial Census Plans

The Census Bureau asked the National Research Council again in 1978 to review decennial census methodology, specifically the plans for the upcoming 1980 census. The NRC's Committee on National Statistics set up the Panel on Decennial Census Plans, which worked within a very short time span, to: (1) examine field procedures, questionnaire design, and special procedures designed to improve the 1980 census coverage, (2) review proposed procedures for handling contested counts, (3) investigate the feasibility of adjusting census counts, and (4) consider evaluation plans for the 1980 census. The panel's report, *Counting the People in 1980: An Appraisal of Census Plans*, made recommendations in many areas. This panel repeated the call of the earlier committee for imaginative work on the cultural and social problems associated with census-taking. In the area of adjustment, the 1978 panel concluded (National Research Council, 1978, pp. 132-133) that: "methods of adjustment with tolerable accuracy are feasible" and "on balance an improvement in equity would be achieved." The panel supported implementation of procedures to adjust population counts for underenumeration for purposes of fund distribution and expressed confidence in the Census Bureau to determine the best technical procedures for adjustment. The panel

recommended that adjustment "not be applied to the counts used for legislative apportionment nor to the body of census data on the characteristics of the population."

6.3 The 1981-1982 ASA Technical Panel on the Census Undercount

The Census Bureau asked the American Statistical Association in 1981 to convene an expert group to review the methods and results of the programs used to evaluate completeness of coverage in the 1980 census and to make recommendations regarding research in the areas of coverage evaluation and adjustment of census counts. This panel made a number of specific research suggestions and also recommended (ASA, 1984, p. 256): "that the Bureau of the Census sponsor an outside technical advisory group on undercount estimation and related problems."

6.4 The 1984 Panel on Decennial Census Methodology

In response to the recommendation of the 1981 ASA panel, the Census Bureau asked the Committee on National Statistics at the National Research Council to establish the Panel on Decennial Census Methodology. The charge to the panel was for an investigation of three major issues from a technical viewpoint, setting aside legal considerations:

- (1) Adjustment of census counts and characteristics, including exploration of formal criteria to evaluate measures of undercount and alternative adjustment procedures;
- (2) Uses of sampling in the decennial census, including investigation of whether, for a given cost, the sampling of lists and areas to improve coverage and sampling of nonrespondents for follow-up can improve accuracy for the total population and for important subgroups;
- (3) Uses of administrative records, including investigation of various types of records to determine their possible utility in improving the accuracy of census counts and the efficiency of census operations.

The panel interpreted this charge to include investigation of closely related topics, notably methods of coverage evaluation and improvement. Coverage evaluation programs provide the necessary input data for any adjustment and serve the important function of apprising users of the quality of the census counts. Procedures for coverage improvement were viewed by the panel as necessary and desirable whether or not an adjustment procedure is incorporated into census methodology. The panel also investigated uses of census data and their dependence on the accuracy of the census figures. Proper evaluation of the consequences of changes in collection methodology requires an understanding of important uses of the data being collected.

The charge to the panel related to analysis of decennial census methodology and not to other population programs of the Census Bureau. However, during the panel's work, it was clear that the census could not be considered completely in isolation. Demographic and related social and economic statistics are used continually over the decade following each census, and current information is needed for these uses. The Census Bureau has a number of formal programs for updating some of the census information. Hence, the census is the central part of a broader statistical system designed to produce data needed to implement legislation, assist in decision making both by industry and government, and help understand changes taking place in our society. Although the panel did not undertake a study of population statistics programs other than the census, the panel considered the quality of census data compared with the

quality of postcensal population estimates. The panel recommended that the Census Bureau assess the need for a mid-decade census in 1995 in light of the impacts of errors in postcensal population estimates on major data uses, such as fund allocation.

The work of the panel differed in several important ways from the efforts of its predecessors. This was the first panel asked explicitly to consider important changes in decennial census methodology from the perspective of cost as well as effectiveness. A theme running through the charge to the panel is to design a methodology that improves accuracy compared with previous censuses but costs no more, and ideally less, in constant dollars.

Other important differences have to do with the timing of the panel's work in relation to the cycle of decennial census planning. The panel was convened at a point in the cycle when it could benefit from the availability of extensive material regarding the experience in the most recent census. At the same time, the panel carried out its work in an early stage of the planning cycle for the next decennial census before decisions on methodology were fixed. Hence, the panel was in an unusually good position to provide suggestions and guidance regarding the research and testing program for 1990.

7. Major Themes of the Panel's Report

Several themes run through the report of the panel, *The Bicentennial Census: New Directions for Methodology in 1990*. The first major theme can be expressed as the need for balance between traditional and new procedures in the choice of census methodology for 1990. Indeed, balance has characterized the historical evolution of decennial census methodology. The report does not propose that the Census Bureau make radical innovations in decennial census methodology in the near term. The census is a massive and complex operation, and major changes should be made only with care and after thorough evaluation. Nonetheless, the report expresses the belief that it is important to implement changes on some dimensions for 1990 and to undertake planning that may lead to further changes in the future.

Most important, the report argues for balance between efforts to achieve a complete enumeration and efforts to improve the accuracy of census figures through adjustment procedures. The panel believes that adjustment cannot be viewed as an alternative to obtaining as complete a count as possible through cost-effective means. The United States has a long tradition of a census as a complete enumeration in which it is a civic responsibility to participate in the census process. It is important to continue this tradition and important that census methodology should strive for a complete enumeration via counting procedures, including the use of cost-effective special coverage improvement programs. However, the report also states that the ultimate goal of the census should be the accuracy of the census figures. The evidence is overwhelming that no counting process, however diligent, will in fact enumerate everyone. Hence, the report recommends that the Census Bureau carry out a vigorous program of research on coverage evaluation and adjustment methods that, if successful, would permit adjustment of census figures as part of the methodology for the 1990 census.

A second and related theme concerns cost-effectiveness. The panel did not attempt to apply formal cost-benefit analysis to decennial census methodology, but endeavored to identify those proposed changes that show the most promise of improving accuracy without increasing costs or of reducing costs without importantly impairing accuracy. In this regard, the panel's recommendation for research designed to develop appropriate and feasible methods of adjustment of the census counts, together with the Census Bureau's stated goal to contain costs for the 1990 census, implies that some budget resources must be shifted from coverage improvement to coverage evaluation and adjustment. Specifically, the panel argued in its report that coverage improvement programs used in previous censuses should be carefully reviewed to determine their

efficacy. Costly programs that neither correctly added significant numbers of people to the count nor importantly reduced differential undercount should be dropped from the Census Bureau's plans for 1990. Effective programs should be further refined through testing and research, and the budget should make room for testing some new ideas in this area.

While not favoring extensive use of sampling to obtain the count, the panel in its report supported research on sampling in the later follow-up stages of census operations and in some coverage improvement programs, such as the program to recheck the vacancy status of housing units. Limited use of sampling may effect measurable cost savings with minimal sacrifice of accuracy. Careful use of sampling for certain coverage improvement programs may, in fact, improve accuracy by reducing duplications and other erroneous enumerations, in addition to identifying missed households and people.

In considering cost and accuracy, the panel stated its belief that it is important to look at the characteristics data collected in the census as well as the population count. There is strong evidence that important subject items have severe reporting problems. The panel recommended a strategy of looking closely at each item proposed for inclusion on the questionnaire to determine: (1) the need for that item, (2) the level of geographic detail required by users, and hence whether the item must be asked of all households on the short form questionnaire, or whether it can be asked of a sample on either the long form or on a much smaller follow-on survey, and (3) whether some other source could provide higher-quality data. The panel suggested exploring the use of administrative records together with sampling to obtain data on some housing structure characteristics. Such data could be more accurate than individual responses on the census form. Costs initially may be high, but should decline over time. This particular use of administrative records has the advantage that it should present no actual or perceived threat to individual privacy.

A third major theme of the report concerns the strategy for designing the 1990 census, whatever the particulars of the methodology may turn out to be. The research plans drafted by the Census Bureau staff are extremely comprehensive and ambitious. The staff has clearly tried to include all reasonable ideas for consideration in the research and testing program. The panel commended the Census Bureau's efforts to design and carry out a thorough research and testing program that will support sound decisions regarding methodology for the 1990 and later censuses.

The panel expressed its belief, however, that in most areas the Census Bureau must choose among all the ideas and procedures proposed for testing, given constraints on available staff and budget resources and the limited time available to analyze test results and use them to guide decisions on methodology. The exception concerns research related to adjustment, including research on coverage evaluation methods. In this area, the panel stated that research must proceed on a broad front if effective methodologies are to be developed for 1990. In other areas, the panel endeavored to recommend strategies for choosing priority projects for inclusion in the 1990 census research and testing program and also recommended the use of less costly research methods, where appropriate, including more detailed analysis of 1980 census results, in place of full-scale field tests.

8. Overview of the Panel's Recommendations

In the remainder of the paper, we summarize the recommendations of the Panel on Decennial Census Methodology.

8.1 Recommendations on Adjustment of Population Counts

The first issue in the charge to the panel was that of adjustment of the census counts. Based on review of the evidence regarding coverage and other kinds of errors in the census and of the literature on the important uses of census data, the panel found a need for adjustment to improve the accuracy of the census numbers, particularly to reduce differential coverage errors across geographic locations and demographic groups. The panel was led to recommend development of adjustment procedures, but as a complement to--not a substitute for--continued efforts to improve census coverage. If public perception of the importance of being counted should deteriorate, this would have serious consequences for the accuracy of the figures, adjusted or not.

Recommendation. Completeness of the count is an important goal, both for ensuring the accuracy of the census and for establishing the credibility of the census figures among all users. Adjustment should not be viewed as an alternative to obtaining as complete a count as possible through cost-effective means. Nevertheless, the ultimate goal is that of the accuracy of the published figures. Given the likelihood that the census will continue to produce different rates of undercoverage for various population groups, and given the equity problems caused thereby, we recommend that work proceed on the development of adjustment procedures and that adjustment be implemented if there is reasonable confidence that it will reduce differential coverage errors.

The panel also investigated criteria for evaluating the numbers produced by the census (based on either unadjusted or adjusted counts), considering both the errors in the numbers themselves and the resulting loss to society due to erroneous treatment of political jurisdictions in terms of representation, fund allocation, and other uses of the data. The panel considered various yardsticks or loss functions, that is, numeric measures of the impact of census errors, from the viewpoint of the data user and as they relate to adjustment. The discussion of this topic in the panel's report notes that no adjustment procedure can be expected to simultaneously reduce the error of every piece of census information for every geographic area; rather, there is an important net social gain if differential coverage error is generally reduced. The panel expressed the belief that it is more important to reduce the overall error per person than the overall error per place and recommended that loss functions for measuring total error take into account the population size of each jurisdiction. In discussing technical considerations concerning choice of loss functions, the panel concluded that good adjustment procedures should be expected to perform well for a range of loss functions. Moreover, no type of jurisdiction should have substantial reason to believe that its population could have been estimated more accurately some other way. Where the choice of adjustment procedure depends importantly on the choice of loss function, this suggests that the particular adjustment procedure has weaknesses that need to be addressed.

Recommendation. In measuring the total loss associated with an adjustment procedure, we recommend that the contribution to this loss attributable to a geographic region should reflect its population size. Thus, we recommend against loss functions based solely on the number of political entities losing or gaining through adjustment.

Recommendation. We believe that, in general, the results of an adjustment are likely to be affected more by the quality of coverage evaluation data and the models and methodology used than by the choice of loss

functions. Given a family of loss functions with relatively similar objectives, it should be possible, and desirable, to determine an adjustment procedure that has good performance for most or all of them. We recommend that the Census Bureau investigate the construction of adjustment procedures that are robust to a reasonable range of loss functions.

The panel considered the problem of estimating the likely range of error introduced by the particular procedure adopted for an adjustment. Although error can be measured only imperfectly, information about the distribution of error is important in the same way that sampling variances for sample surveys provide useful information.

Recommendation. We recommend that the Census Bureau explore methods for providing estimates of errors associated with estimates of census over- and undercoverage, with a view to publishing such error estimates along with coverage evaluation results and any adjusted census data that may be issued.

Adjustment of census data could create problems of inconsistency between aggregate statistics and microdata from the census. The panel stated its belief that internal consistency is an important quality for general purpose statistics, such as those produced by the decennial census, which have a wide range of output and many uses. The report discusses reasons to carry down any adjustment of population estimates for larger geographic areas to the level of the individual micro-records and reviews methods, such as weighting and imputation, for accomplishing this.

Recommendation. The panel believes that it is important to strive for internal consistency of published census figures. Should adjustment appear feasible and effective, methods exist for distributing adjusted totals for aggregated groups down to subgroup values. We recommend that one of these methods be used to achieve internal consistency of census figures.

Adjustment also presents problems of timing. Current law requires submission of state population counts within 9 months after Census Day for purposes of reapportionment and of small-area counts within 12 months after Census Day for purposes of redistricting. The report discusses the pros and cons of various scenarios with regard to release of adjusted data if it proves impossible to implement a full-scale adjustment in time to satisfy the above constraints. Congress clearly will need to stipulate which scenario is preferable for apportionment purposes.

Recommendation. Census data used for reapportionment and redistricting are required by law to be produced no later than specific dates. It is possible that adjustment of the 1990 census will prove feasible and effective in all respects, except for the ability to meet the required deadlines. This should not necessarily preclude subsequent issuance of adjusted data for other uses. In this situation, we recommend that the Census Bureau seek determination by Congress of whether it desires that adjusted data be used and will therefore extend the deadlines, or wishes to adhere to current deadlines and will therefore stipulate the use of unadjusted (or partially adjusted) data for reapportionment and redistricting.

The panel reviewed possible technical approaches to the use of data from coverage evaluation programs for adjusting the raw census figures. The review covered procedures for starting out, that is, for developing estimates for a limited number of large geographic areas, and procedures for carrying down, that is, for using the large-area estimates to develop adjustments for small areas and ultimately for the microdata records. The discussion of this topic in the report considers the Census Bureau's plans for research and testing of adjustment procedures in upcoming pretests and makes recommendations for priority research areas.

Recommendation. The panel recognizes that considerable work is still necessary and likely to lead to improved procedures for adjusting census data. We therefore support the Census Bureau's stated plans to pursue, internally, research and development of adjustment procedures, and we also recommend that the Census Bureau vigorously promote and support related statistical research in the academic community.

Recommendation. The panel supports the Census Bureau in its plans for a 1986 pretest of adjustment operations, including the production of mock tabulations of adjusted census data. We recommend analysis of the resulting adjusted and unadjusted data sets, to help identify the strengths and weaknesses of the particular methods tried.

Recommendation. We recommend that research on adjustment include: (1) investigations of the assumptions underlying the procedures, (2) an attempt to evaluate empirically the more important of the assumptions as well as the sensitivity of methods to violation of assumptions, (3) study of methods used for carrying down estimates to lower levels of aggregation, and (4) a study of the impact of adjustment on uses of census data.

8.2 Recommendations on Methods to Measure the Completeness of Census Coverage

For adjustment to be feasible, evaluation programs must be good enough to provide estimates of net undercoverage that are reliable for at least large geographic areas and have error properties that are broadly understood. Coverage evaluation programs also provide valuable information for users of the data and for the Census Bureau in planning subsequent censuses. Although in general the panel recommended that the Census Bureau narrow its 1990 census research and testing objectives, in the area of coverage evaluation the panel expressed the belief that it is too soon to focus on one method to the exclusion of others.

The report reviewed the problems associated with each of the major methods of coverage evaluation and the Census Bureau's current plans for research and testing directed toward coverage evaluation of the 1990 census. The panel argued against the Census Bureau's decision to concentrate on post-enumeration (or possibly pre-enumeration) survey methodology as the principal means of coverage evaluation in 1990, noted that the Census Bureau should not put itself in the position of lacking a means of adjustment if there are problems with the operation for matching survey with census records, and urged completion of 1980-based studies related to coverage evaluation.

Recommendation. We recommend that the Census Bureau conduct research and tests of alternative coverage evaluation methodologies in addition to the post-enumeration survey, specifically reverse record checks and systematic observation.

Recommendation. *We agree that matching algorithms are very important to the success of several adjustment methods. We recommend that the Census Bureau investigate the development of a fallback position in case adequate matching is not available in 1990.*

Recommendation. *We recommend that the Census Bureau complete and report analyses of 1980-based tests related to coverage evaluation, especially the Census/CPS/IRS Match Study.*

The panel considered possible improvements and recommended priority research areas for each major coverage evaluation method in turn. The demographic analysis method, which uses data from independent sources including birth and death records to estimate the number of persons at the time of the census in a given age-race-sex category, currently suffers from the absence of data on illegal aliens. The panel recommended research into using demographic analysis for estimates of the native-born population. The reverse record check method, which traces the current location of a representative sample of newborns, immigrants, and persons counted in the previous census or coverage evaluation program, has been widely used in Canada. Tracing is more difficult in the United States because of the 10-year interval between censuses as opposed to 5 years in Canada. The panel recommended completion of a current experiment to test alternative methods of tracing. The report discusses extensively the method of post-enumeration (or pre-enumeration) surveys, in which a sample of households is interviewed and matched with records in the census, and identifies several problem areas for particular attention in the Census Bureau's research.

Finally, the report discusses the idea of using some kind of systematic observation procedure whereby persons residing in a sample of areas would provide independent population estimates. The sample should include but not be limited to areas that have proved particularly hard to count in previous censuses. This method might surmount the problem observed repeatedly in the history of coverage evaluation, namely that persons who are missed by the census are also likely to be missed by an independent survey or other data source.

Recommendation. *We recommend that the Census Bureau conduct research into using demographic analysis to develop estimates of coverage for the native-born population. The research should consider whether these estimates could usefully be combined with other estimates of coverage.*

Recommendation. *We recommend that the Census Bureau move quickly to complete the Forward Trace Study to determine the feasibility of using forward trace methods in a reverse record check program for 1990. If the methodology is effective, a national sample for this purpose needs to be initiated by 1986.*

Recommendation. *We support the Census Bureau's research directed toward developing the 1990 Post-Enumeration Program and recommend that such research emphasize the following areas:*

- (a) *Reduction of post-enumeration survey nonresponse;*
- (b) *Reduction of unresolved matches between records for individuals listed in the post-enumeration survey and the decennial census;*

- (c) *Validation of the assumptions and/or development of alternative methodologies with respect to netting-out of overcounts and undercounts with reference to the place of enumeration; and*
- (d) *Investigation of alternatives to the assumption that the inclusion of individuals in the post-enumeration survey is unrelated to their inclusion in the decennial census and the estimation of the strength of this relation.*

Recommendation. *We recommend that the Census Bureau initiate a research program on systematic observation with a view toward the use of this method for a sample of areas at the time of the 1990 census.*

In the area of adjustment-related research, including coverage evaluation methods, the panel acknowledged that many technical and operational issues need to be resolved if adjustment procedures are to be developed in time for their use in the nation's bicentennial census in 1990. Overall, while much effort will be required, the panel expressed optimism that substantial progress can be made.

8.3 Recommendations on Procedures for Improving the Count

The panel considered not only methods for adjusting the census figures, but also procedures for improving the counts obtained in the field. Most programs directed toward coverage improvement are expensive. They may also introduce error by duplicating or otherwise erroneously adding persons. In general, however, the panel determined that the costs of well-designed and well-executed coverage improvement programs represent money well spent for improving the census figures.

The panel noted the importance of gaining understanding of the problems of undercount and overcount in the census, as the evidence indicates that the field enumeration is not equally effective for all population groups.

Recommendation. *We recommend that the Census Bureau assign a high priority to the completion of studies of undercount and overcount in the 1980 census.*

Recommendation. *We recommend that the Census Bureau set up a timetable and assign staff to permit completion of the analysis of 1990 coverage evaluation results in time to be used in planning the first pretest of the 2000 census.*

The panel considered priorities for research and testing directed toward improvement of items on the questionnaire that relate to coverage, including the questions on race and Hispanic origin. It is important to understand what responses to the race and ethnicity questions mean to develop appropriate estimates of coverage rates for race and Hispanic groups and to relate them to vital statistics.

Recommendation. *We recommend that the Census Bureau test a variety of question designs for the race and ethnicity information to be collected in the 1990 census, including some that combine the collection of information on Hispanic origin with the other race and ethnicity information.*

Recommendation. *We recommend that the Census Bureau, in addition to other methods that it has traditionally employed, use the technique of focus group discussions as one means to develop questions on particularly sensitive items such as race and ethnicity.*

Recommendation. *We recommend that, in 1990 as it did in 1980, the Census Bureau collect, tabulate, and release data on race and ethnicity in such a way that the data can be reaggregated as necessary to obtain maximum feasible comparability with 1980 and 1970.*

Recommendation. *We recommend that the Census Bureau, the National Center for Health Statistics, and other relevant federal agencies work closely together to design questions and response editing rules on race and ethnicity that minimize conceptual differences between census and vital statistics records to the extent feasible. The Office of Management and Budget should act as necessary to facilitate such coordination.*

The panel evaluated experience in the 1970 and 1980 censuses with questions on the short form designed to aid in achieving a complete and accurate count, such as questions probing for a complete roster of household members. Increasing problems are posed for an accurate count by the mobility of the population and recent trends in living arrangements that have resulted in growing numbers of persons with two or more usual residences (for example, retired people with summer and winter homes). The panel suggested a question for testing directed toward improving coverage of young adults and children in hard-to-count areas.

Recommendation. *We recommend that the Census Bureau give high priority in its planning for 1990 to research and testing of questions and enumeration procedures that address problems of accurately counting persons in the process of moving, households with second (vacation) homes, and persons with more than one usual place of residence.*

Recommendation. *We recommend, as one procedure to consider for improving coverage of hard-to-count groups, that the Census Bureau pretest a question asking parents for names and addresses of children who are not part of the household. This question should be included in the 1986 pretests.*

The panel also made an overall assessment of special enumeration procedures designed to improve the count. While believing that programs such as the recheck of vacant units can make important contributions to improving coverage, the panel did not subscribe to the view that every coverage improvement idea that is suggested or has been used in the past should be included in the plans for the next census. The panel recommended paring down the list of programs to be considered for 1990 and the list requiring early field testing.

Recommendation. *We recommend that the Census Bureau review coverage improvement programs used in past censuses and proceed with research and testing directed toward use in 1990 of those programs that: (1) exhibited a high yield in terms of numbers of missed persons correctly added to the count and/or contributed significantly to reducing differential undercoverage, (2) exhibited low-to-moderate costs per person correctly added, and (3) did not add many persons incorrectly. Programs that do not satisfy these criteria should be dropped from consideration unless: (1)*

the program exhibited low total dollar costs and had demonstrable public relations or goodwill value in previous censuses or (2) there is some particular reason to believe a revised program will yield greatly improved results.

Recommendation. *We recommend that the Census Bureau conduct full-scale pretests in 1986 only of those coverage improvement programs that require such testing. Furthermore, we recommend that the Census Bureau use focus groups that include members of hard-to-count populations as one means to explore coverage improvement techniques and to narrow the range of options to be field-tested.*

8.4 Recommendations on Uses of Sampling and Administrative Records

The panel reviewed two major methods that have been proposed to improve the cost-effectiveness of the decennial census--the use of sampling in obtaining the count and the use of administrative records. With regard to sampling for the count, the panel noted problems of replacing the census with a large sample survey: sampling on the scale necessary for satisfaction of present demands for small-area data would complicate field operations, reduce costs relatively little, and probably exacerbate problems of coverage errors compared with a census. The use of sampling for follow-up of households that do not return their census questionnaires has some of the same drawbacks, but sampling could prove cost-effective in the final stages of follow-up in which it is very expensive to count an additional person. Although the Census Bureau has dropped plans to study the use of sampling for follow-up and for coverage improvement programs such as the recheck of vacant units in 1986, the panel expressed support for research in these areas. The panel also supported further testing of telephone follow-up of nonresponding households, which was tried experimentally in 1980. Finally, the panel underscored the need to maintain machine-readable records of the follow-up history of individual households that will permit detailed analysis and simulation of different sample designs.

Recommendation. *We recommend that the Census Bureau not pursue research or testing of a sample survey as a replacement for a complete enumeration in 1990.*

Recommendation. *We recommend that the Census Bureau include the testing of sampling in follow-up as part of the 1987 pretest program. We recommend that in its research the Census Bureau emphasize tests of sampling for the later stages of follow-up.*

Recommendation. *We recommend that the Census Bureau consider the use of sampling for those coverage improvement programs that are implemented in the final stages of census operations and where there is potential for significant cost savings. We recommend that the Census Bureau simulate sampling in the Vacant/Delete Check program in an upcoming pretest.*

Recommendation. *We support the Census Bureau's plans for further testing of telephone follow-up procedures in 1986. We recommend that the Census Bureau review the implications for sample-based follow-up operations of the operational difficulties that were encountered in the 1980 telephone experiment.*

Recommendation. We recommend that the Census Bureau keep machine-readable records on the follow-up history of individual households in the upcoming pretests and for a sample of areas in the 1990 census, so that information for detailed analysis of the cost and error structures of conducting census follow-up operations on a sample basis will be available.

In addition to evaluating the uses of sampling for obtaining the basic head count, the panel reviewed the use of sampling for content items in the census. Historically, in every census since 1940, some items have been asked of only a sample of the population in order to reduce response burden and processing costs while obtaining the benefits of additional data. Sample designs and sampling fractions have differed in recent censuses. The Census Bureau considered a design for 1990 that would include a short form containing items asked on a 100 percent basis, a long form containing additional items asked of a large sample, and a follow-on survey of a small percentage of short-form households administered within a few months of Census Day that would obtain yet other information. The panel did not offer specific recommendations in this area, but noted that the criteria for including items in the follow-on survey have not been explicitly articulated but should be to permit thorough assessment of the need for the survey and for the inclusion of particular items.

Recommendation. We recommend that the Census Bureau refine and make more explicit its criteria for inclusion of items in the proposed follow-on survey that is being considered for the 1990 census.

Finally, the panel investigated the use of administrative records for improving the accuracy of content items. The concern over completeness of population coverage in the census can obscure equally valid concerns over the accuracy of the content. There are well-documented problems with the reporting of content items such as income, utility costs, and age of structure. The panel recommended research and testing directed toward improving the data quality of key items. The research program should include design of operations to verify, and possibly adjust, responses as part of the census operation and should investigate the possibility of obtaining some items, such as housing structure information, from administrative records sources.

Recommendation. We recommend that the Census Bureau conduct research and testing in the area of improved accuracy of responses to content items in the census. We recommend further that the content improvement procedures examined not be limited to reinterviews of samples of respondents, but include the use of administrative records.

Recommendation. We recommend that the Census Bureau investigate the cost and feasibility of alternative ways of obtaining data on housing structure items. Possibilities include: (1) obtaining housing structure information on a sample basis from administrative records and using this information to verify and possibly to adjust responses in the census; (2) obtaining structure information solely from administrative records and dropping these items from the census; and (3) asking structure questions of a knowledgeable respondent such as the owner or resident manager. We recommend that any trial use of a "knowledgeable" respondent procedure include a check of the data obtained from such respondents against data from administrative records.

8.5 Recommendations on Research and Testing for the 1990 Census

The panel reviewed the Census Bureau's research and testing plans for the upcoming 1990 census, with particular emphasis on the plans for pretests in spring 1986. The panel expressed several major concerns with the 1986 research and testing program which appeared too ambitious for the time remaining before the census and for the staff and budget resources likely to be available, particularly if key data are to be analyzed in time to support major decisions. In the panel's view the program also placed too much emphasis on field testing over other kinds of research, including further analysis of existing data. The panel suggested some ways to scale back the 1986 testing program.

Recommendation. *We recommend, to ensure cost-effective field testing and preservation of adequate resources for analysis, that the Census Bureau attempt to identify research and testing proposals for 1986 that:*

- (a) *Can be pursued with other research methods and omitted from the 1986 field test program;*
- (b) *Can be safely deferred for research or testing until 1987 or until the dress rehearsals;*
- (c) *Are unlikely to be viable for 1990 but should be incorporated on an experimental basis into the 1990 census as a test for future censuses; and*
- (d) *Should be omitted entirely from consideration for the 1990 census, based on previous census experience or other survey research results.*

Recommendation. *We recommend that the Census Bureau make full use of data from the 1980 census and from experiments carried out in 1980 to help guide planning for 1990. To this end, we recommend that the Census Bureau assign a high priority to completion of 1980 census methodological studies, and we encourage further analysis of these data where appropriate.*

Throughout its report, the panel endeavored to identify priority areas for research and testing to support the choice of methodology for the 1990 and future censuses in the U.S.

Mr. GARCIA. I want to backtrack a little bit if I can. You may have made mention of it, but I just want to make sure because one of the individuals who is going to testify, a person who obviously I have to be quite concerned about, is Mr. Carlucci, who handles the statistical data on how we are going to reapportion the State of New York for the 1992 election. But I just want to make certain we understand.

I remember Detroit, and I remember New York, and I remember a series of cities that sued the Bureau of the Census and sued on a question of "adjustment." If, in fact, the adjustment is made, when will that adjustment be made? When will figures and statistics be available to the States?

Dr. BAILAR. We are trying very hard to meet a schedule that we have those be the official census figures, so that they would come out December 31, 1990.

Mr. GARCIA. Of 1990?

Dr. BAILAR. Right.

Mr. GARCIA. OK. Because then we end up with the constitutional question of the one man, one vote, and we could end up in another series of litigation which could probably disturb and overturn everything that we have done in 1990 in preparing for the 1992 reapportionment.

As I said before, Mr. Carlucci, who is from the State of New York, is going to testify, believes that there is a danger that any adjustment the Census Bureau makes would, in fact, be troubled by the same problems as the enumeration. He believes that adjusting the census will not help groups who are otherwise missed and that, that it is going to be unfair.

I guess the question is can you tell us do you think this is a problem? When I say you, I am talking about Census Bureau. And if so, what are you going to do to investigate it or, hopefully, correct it?

Dr. BAILAR. Well, I recognize Mr. Carlucci's concerns, and it is probably the case that we are not going to be able to make a perfect adjustment, just as we don't have a perfect census. However, the idea that we will not be improving the census by being able to adjust for some of the missed people, I think we are going to be able to do that. And by using the two methods together, by using both the postenumeration survey and the demographic analysis together, I think we will be able to make real improvements in those groups of people that we have missed.

Mr. GARCIA. Again, here on Capitol Hill there are those who might think that an adjustment is a way of influencing the outcome of the census. If, in fact, you decide to adjust the census, how will you be able to do it without giving interested groups the idea that the adjustment would be the occasion for a political compromise—and I underline the words "political compromise"—that would affect the outcome? I guess the bottomline is, How do you preserve the integrity of the census?

Dr. BAILAR. Well, I think first of all people have to realize that the census process itself is not a fixed process over the years; that there have been changes in the censustaking procedures, that we have made adjustments in the census; that by substituting people in, by imputing people, we have already made adjustments. That this final process of adjustment is just at the end—at the very end

of a census process designed to count every person that we possibly can by enumeration methods—then this process would be at the end to try to correct for the final problems if they still exist.

I think there are some people who will never be convinced that this isn't a political process. But by the decision process we are going through, by trying to involve a lot of people outside the Census Bureau as well as within, we are certainly trying to make it an unpolitical process.

Mr. GARCIA. Dr. Bailar, again, there are some people who probably say: Well, look, if you are going to adjust the census, the heck with it. I am not going to participate. You will just count me in anyway. And others, especially here on Capitol Hill in light of Gramm-Rudman might even say to you: Just adjust the whole damn country. Do the best you can and look at the billions of dollars we will save.

What is your response to that?

Dr. BAILAR. First of all, you can't do an adjustment without taking a census first. An adjustment is based on both the numbers from a census as well as what you do afterward in a census evaluation or demographic analysis.

We have also looked at the results both in Australia and in England where they have adjusted the census and asked them what was the public reaction. It was a very "ho-hum" attitude. Most people just don't realize that you have done it. And it really isn't different from other things that we do in current surveys. I think that some people will always be convinced that a group of people won't cooperate because you are doing something. I don't think there is any evidence to support that.

Mr. GARCIA. I am not sure if I understand the procedure in the United Kingdom in terms of taking the dollars, Federal dollars, and how those dollars are distributed throughout the country. Are they done by census tracts, or the Government just says we are going to put so much in Liverpool and so much in Birmingham and so much in London? How does that work? Because here in the United States the Coleman Youngs and the Ed Kochs and other mayors, are concerned because of our funding formula. I am not sure how the United Kingdom works, as I said before. So it may be "ho-hum" over there, but the editorial boards and the writers within the various regions of our country will not take that same attitude if they feel that that section of the country is not going to share in what they consider to be a fair procedure. And most of our moneys are handed out based on population and we have different levels, which means different funding levels. So this is something that I feel that they can say ho-hum over there, but I don't think that will happen here.

Dr. BAILAR. Well, I don't think mayors of cities are going to go ho-hum about what we do in the census. I agree with you there. In England, when they adjusted, they made one adjustment and that was to the city of London. And since that is the biggest city there it certainly took care of some interests. I am not fully aware of how they distribute money there.

Mr. GARCIA. Well, because I just feel that we have a different situation here in the United States and everybody is cognizant of what you are doing. Maybe the average citizen is not, but I can tell

you that those of us who are responsible in one form or another for funding localities, we are quite concerned about the census.

And the second part of it is those politicians, whether at the State, local, or the Federal level, everyone of us are concerned as to how those numbers are going to fall as well because that is going to determine the next 10 years of government.

Dr. BAILAR. Yes, I agree. I think the census counts are very important, and I also think that any improvements that we can make that we are fully satisfied are going to improve those counts should be things that people would be satisfied with, if they are fully cognizant of the fact that we are trying to make improvements as we go along.

Mr. GARCIA. Suppose you come up with a plan that will produce adjusted numbers and you don't release them because you feel they don't have to be released.

Dr. BAILAR. Yes.

Mr. GARCIA. What would be the perception in this country of the Bureau of the Census having two sets of figures?

Dr. BAILAR. Well, the Bureau of the Census would only have one set of official numbers, and those would be those that we release. We would, of course, as you have read in the testimony, have these other unadjusted figures inhouse and we would release them, as we do every time after a census, in one of our evaluation reports. We would view those then as a measure to be used for evaluation but not for adjustment. But they would be released.

Mr. GARCIA. Dr. Fienberg, I guess you have spent enough time listening to Dr. Bailar. What is your reaction to some of the testimony that she has put forth?

Mr. FIENBERG. Well, I am actually very pleased. As I wrote my testimony for the record, I was very concerned that a process that began almost 5 years ago, just after the 1980 Census, working toward the development of methodology and agreement within the professional community, had somehow been sidetracked and that the work within the Bureau had not been progressing at the rate that I felt was necessary in order to get things done for 1990. As you mentioned in your opening statement, some people think it is awfully early to be talking about 1990. My reaction is it may be too late. And I was very concerned, as I mentioned at the previous hearing in May, that adjustment had disappeared off of the agenda of the Bureau. I think Dr. Bailar's statement suggests that the contrary is true, and I think the kind of schedule she proposes is one that is very compatible with discussions we had at the beginning of plans for the Committee on National Statistics' panel. I think not only am I pleased, but if the rest of our panel were to have an opportunity to read this testimony, they would feel that it was quite responsive to the panel's recommendations of a year ago.

Mr. GARCIA. Is the national academy going to be prepared to play the role of reviewing and evaluating and making recommendations?

Mr. FIENBERG. I think the academy is very anxious to play that role. The Committee on National Statistics views its Decennial Census Panel as its most important panel in the sense that this is the big statistical activity in this country, and the fact that we can provide advice and provide input to the Bureau in its decisionmak-

ing is very important to the members of the committee. We are very anxious to be of assistance.

Mr. GARCIA. I guess it takes a while for the academy to prepare its reports. Do you think that your panel would be able to act in time to provide meaningful input to the Bureau in a way that is going to help us politicians in our reapportionment?

Mr. FIENBERG. The academy has its own slow ways, and I fight it as much as the people on the outside do when I am on the inside. But we have a variety of other mechanisms for responding; in particular, the mechanism of letter reports, which are brief reports without the extensive academic-type documentation, which I think is the kind of response that the Bureau is looking for in the crucial decisions that it is going to face. I don't see any problem whatsoever in our providing that kind of timely advice.

Mr. GARCIA. Counsel would like to ask a question.

Ms. FERNANDEZ. In your testimony you state that the adjustments will be based on statistical models rather than direct estimates for a block. We have a constitutional requirement that every 10 years we will apportion according to the population in existence. I would think that your statistical models methods potentially could lead to more than the 50 lawsuits that the Bureau experienced subsequent to the 1980 Decennial on the question of what is the actual number of people in a particular district.

How will these adjustment methods have an impact in terms of those numbers and people's perceptions, especially political perceptions, on whether or not each congressional district is equal to each other? What do you anticipate in terms of those issues being raised?

And also, the other question I have is that in your testimony you also state there is a process where you have outsiders' evaluations, and an internal technical group within the Bureau of the Census that will be making a recommendation. But essentially the line in your testimony that I found still a little amazing was "the Director will then make and issue the final decision." Will he be announcing the recommendations of that panel? I'm a little wary because we acknowledge that the Director of the Bureau of the Census is a Presidential appointee.

Can you please address those issues?

Dr. BAILAR. I can certainly try. On the first one, how are we going to make the adjustment down to the block level, what we intend to do is to set up a number of strata in which each stratum would have blocks of like characteristics, and we would make estimates of the undercount from each one of those strata. Then, based on either using a synthetic adjustment or with some kind of regression analysis, we would be able to use those estimates at that level to make adjustments down to the block level.

At the block level we would probably do something very similar to what we do now when we don't know what the tenure of a household is and we have to decide whether it is occupied or vacant, and we do a substitution process. We would probably do something of that nature, though we haven't made that decision yet.

You have to realize, too, that in most blocks these additions—unless we really don't have a successful census, the additions at a

block level would probably be quite small. It could be large at a city level, but it could be at each block level not very large.

The second question about how we make this decision and that the Director will make and issue the final decision, at each point along the way the external group will make recommendations. Those are open recommendations. They will be widely known, more than to the Census Bureau. The internal group in itself will make recommendations, and those things will also be open. Then the Director will look at those things and make his decision based on those. That is the role of the Director. He is the Director of the Bureau.

Mr. GARCIA. Let me thank both of you. Before you go, Dr. Bailar, just let me say that in the last 3 or 4 days, I have been in the midst of a big battle trying to make certain that certain forces honor the confidentiality of what the Bureau of the Census has always stood for, and I think we have won a battle. So we will keep you posted on that. But I have asked them to shift gears and not make the Bureau of the Census responsible for the data as it relates to the new immigration bill, so that title 13 will continue to be protected and make sure that the confidentiality is something that is maintained.

I want to thank both of you for being with us today.

Dr. BAILAR. Thank you.

Mr. GARCIA. Our next panel is Dr. Michael Stoto, professor, John F. Kennedy School of Government, Harvard University; Mr. Carl Carlucci, executive director of the Legislative Task Force on Demographic Research and Reapportionment; Dr. Eugene Ericksen, professor at Temple University; and Dr. Joseph Waksberg, who is the vice president of Westat.

We will start panel II off with Dr. Michael Stoto, professor, John F. Kennedy School of Government.

STATEMENTS OF MICHAEL A. STOTO, ASSOCIATE PROFESSOR OF PUBLIC POLICY, JOHN F. KENNEDY SCHOOL OF GOVERNMENT, HARVARD UNIVERSITY; CARL P. CARLUCCI, PH.D., EXECUTIVE DIRECTOR, NEW YORK STATE LEGISLATIVE TASK FORCE ON DEMOGRAPHIC RESEARCH AND REAPPORTIONMENT; EUGENE P. ERICKSEN, PH.D., ASSOCIATE PROFESSOR, DEPARTMENT OF SOCIOLOGY, TEMPLE UNIVERSITY, AND SPECIAL CONSULTANT, NATIONAL ECONOMIC RESEARCH ASSOCIATES, INC.; AND JOSEPH WAKSBERG, VICE PRESIDENT, WESTAT, INC.

Mr. STOTO. Mr. Chairman, thank you for the opportunity to appear before you today. The census undercount and adjustment issue is extremely important for the quality of our national statistics and the policy decisions that depend on them. Your subcommittee is to be congratulated for having the foresight, at a time when there is little public interest in the 1990 census, to review the Census Bureau's plans.

In my statement today I will focus on three points: First, appropriate adjustments to the 1990 census require a substantial statistical effort now and in the coming years; second, the Bureau should develop and employ multiple undercount estimates which rely on different statistical assumptions; third, decisions about adjusting

future censuses should depend on both statistical and political judgment.

After the 1980 census, I was asked to testify in New York about the Bureau's decision not to adjust that census. Although there was evidence of substantial undercounts in some areas, there were no good estimates of how large those errors were. The best available estimates of the undercount seemed to be no better than the census figures themselves. Faced with this difficult situation, the Bureau judged that the adjusted figures would be no more accurate than the original census figures, and I supported this decision. I believe that this situation arose because, in the 1970's, the Bureau was firmly opposed to adjusting the census under any conditions and did not develop an adequate undercount and adjustment program. In 1990, we must be better prepared.

Since 1980, the Census Bureau's attitude toward census adjustment has changed in a positive way. The Bureau's current position is sound: Take the best possible census and prepare to adjust if the accuracy of the basic census counts and the coverage measurement program so warrant. Good estimates of census undercount, however, do not come easily or inexpensively. They require a substantial investment in research and testing and in statistical operations before, during and after the census. From what I have seen as a member of the American Statistical Association's Census Advisory Committee, the Bureau has initiated a strong research program and it is planning a major effort at the time of the census itself. In order to ensure a high-quality census in 1990, the Bureau's current undercount and adjustment efforts must be continued and, perhaps, strengthened.

The centerpiece of the Bureau's plans for 1990 is a coverage measurement survey, sometimes known as the postenumeration survey or preenumeration survey or a PEP. Although there were problems with this method in 1980 and earlier, the Bureau plans several important changes for 1990. With these changes, the approach represents our best hope for an accurate estimate of the undercount.

However, like all statistical techniques, coverage measurement surveys rely on assumptions. Thus, they always include some degree of error.

One way to learn something about the actual magnitude of such errors is to compare estimates that rely on different assumptions. If two estimates based on different techniques agree, this in itself is evidence that the techniques are working well. If the two estimates do not agree, it is still possible that one of them is correct.

The Bureau has considered taking coverage measurement surveys both before and after the census. This effort would offer some independence, but both estimates would reflect to some degree the same sorts of nonsampling errors. Unfortunately, only a limited number of alternatives to coverage measurement surveys are available for 1990.

Demographic analysis, which has been used since 1950 to calculate undercount estimates, relies on assumptions that are different from the assumptions of coverage measurement surveys. Demographic analysis, however, only provides estimates for the country as a whole, not for State and local areas. Thus, the comparison

tells us little about the accuracy of the geographical distribution of the undercount.

The Bureau has considered and experimented with undercount estimation techniques such as administrative record checks, forward-trace studies, a super census, and systematic observation. As individual techniques, none of these seems as promising as coverage measurement surveys. However, these techniques do rely on assumptions that are different from those of coverage measurement surveys. In light of the importance of knowing about the accuracy of undercount estimates, it would be useful to employ as many independent estimates as possible in 1990.

Between now and 1990, the Bureau plans to build a consensus about criteria for adjusting the decennial census. This is an important goal that deserves the attention and cooperation of both the scientific community and government policymakers.

In developing these criteria, the Bureau should remember that there are many dimensions of accuracy and that a single comprehensive index will be difficult to find. In addition, errors have both systematic and random components, and these may deserve different treatment. Census adjustment aims to reduce systematic errors. But because all statistical techniques are subject to some error, all adjustment methods introduce at least some random error. Because society is more concerned with systematic error, we are willing to tolerate some added random error, but how much? This is not a simple question and the answer goes beyond purely statistical considerations.

Thus, defining "accuracy" requires a dialog between statisticians and policymakers. Statisticians have a responsibility to inform policymakers about the characteristics of the available methods, and policymakers must inform statisticians about their concerns. This dialog should take place before the results of the census are known, that is before every decision will have concrete implications for individual States. One way to carry on this dialog is through a series of simple hypothetical examples designed to illustrate the connection between the measure of accuracy and policy relevant variables. If this were done before 1990, the Census Bureau officials who must implement any adjustment could learn about the values and concerns of policymakers in a setting that is not as politically charged as it will be afterward.

On the statistical side, I prefer general criteria rather than specific. The decision to adjust should be made by the Bureau's statisticians with the advice of others, rather than arbitrary formulas. I say this because there are no direct connections between easily obtained measures, such as survey response rates, and the many dimensions of accuracy that concern policymakers. No one can say with certainty that if the coverage measurement survey has a non-response rate less than X, a nonmatch rate less than Y, and so on, the adjusted counts will be more accurate than the census figures themselves.

Instead, I believe the Bureau should; One, develop a consensus among policymakers and statisticians about the meaning of accuracy, two, find out as much as possible about the characteristics of various adjustment estimation techniques and their implications for the various sorts of accuracy, and three, rely on the judgment

of its statisticians, inside and outside the Bureau, to decide whether the adjusted data would provide greater accuracy than the original census figures themselves.

I realize that this approach relies heavily on professional judgment. I believe, however, that with a dialog between statisticians and policymakers in the next few years and before the census, this approach will lead to the best possible census data in 1990.

Mr. GARCIA. Mr. Carlucci?

STATEMENT OF CARL P. CARLUCCI, PH.D., EXECUTIVE DIRECTOR, NEW YORK STATE LEGISLATIVE TASK FORCE ON DEMOGRAPHIC RESEARCH AND APPORTIONMENT

Mr. CARLUCCI. Thank you, Congressman Garcia. I want to thank the subcommittee for inviting me here to testify on the subject of the undercount and population adjustment procedures for the census.

In 1979, I was executive director of the Legislative Advisory Task Force on Demographic Research and Apportionment, and the goal of that body was specifically and only to monitor the census, to prepare for the release of the numbers and then to reapportion the State. At that time I was able to participate in the discussion of undercount and adjustment procedures, and find that the discussion that we are participating in today reflects those same concerns and the changes between that discussion and this discussion are not as great as one might expect.

I don't plan to talk about the specifics of the adjustment. I am not a statistician and I am not a demographer. But I do see that a number of policy questions are raised, and I would like to try to separate the question of making an adjustment as a policy and making a decision about the technology used in the count.

Regarding the first issue, I am not alone in identifying it as an issue of policy. The NRC group has recognized that this is a policy decision for a number of reasons: its legal and political ramifications, and because the adjustment procedure would lead to even more challenges to the census results and possibly delay the release of data. The panel's conclusion that no adjustment methodology would clearly be technically superior dismiss the notion that the decision to adjust the count could be a purely technical one.

Adjusting the count will almost certainly change the public perception of the decennial census, and that may also change the perception of the Bureau and the Bureau's mission.

What would the impact of an adjusted count be? Well, we have a substantial body of knowledge about how it would change the distribution of Federal dollars, but the impact of an adjustment on congressional and State legislative reapportionment is not as clear. The distribution of funds is an administrative process; it goes on continually, changes are made repeatedly and in small amounts, and it could be corrected by administrative action. Apportionment is a once-in-a-decade decision and involves large units that are indivisible, seats—you can't award fractional seats to States—and it requires legislative and court approval. Funding is by its nature quantitatively easily subject to adjustment; apportionment is not.

According to the work of the Bureau, the impact of an adjustment on reapportionment would be small. But the Bureau points out that the undercount is not uniform across States and, if the Bureau's methodology is applied using various assumptions, you produce different results. The Bureau's studies use average underenumeration rates with no variation for communities and make little or no attempt to deal separately with the white Hispanic population. In fact, in today's testimony the same statement is made. That those groups have been undercounted, we don't know the extent of the undercount, and that those groups, especially the groups that have large numbers of aliens—illegal aliens especially—will be difficult to handle even under the adjustment procedures we have talked about.

The history in regard to the decision to adjust is clear. The 1978 Panel on Decennial Census Plans recommended that an adjusted count not be used for reapportionment. The 1985 Panel on Decennial Census Methodology recommends that there be only one count but that adjustment be implemented if there is a responsible confidence that it will reduce differential coverage errors. At a later point, the panel suggests that time pressures will make it impossible to have an adjusted count available for reapportionment of the House of Representatives and that a difficult choice must be made. The panel concludes that the Census Bureau should not make this choice and that in fact the Congress should.

Regarding the adjustment of the census, the methodologies that have been discussed today are well-developed, and I want to simply summarize my comments there by saying that I support the efforts to expand the post-enumeration activities and the efforts to expand the study and analysis of the undercount in general. That will be of benefit to us whether we adjust or not. But the panel believes that the decisions on methodology should also include a characterization of the purposes to which the census enumeration is used. The panel does not provide clear criteria for evaluation or selection of a methodology, leaving the Census Bureau to attempt to make a determination largely on technical grounds. As a matter of policy, any determination should be based on the degree to which these purposes are served.

The result of an adjustment would be that States, if not individual communities, will develop their own calculations and challenge the methodology. Today, even among the panel, it is clear that there are different views as to the methodology, its use and its accuracy. Individual jurisdictions will not agree with the panel's position that a jurisdiction's gain or loss of funds or political representation due to error is understood to be always a nonnegative loss from society's point of view. Furthermore, it is a fact that the undercount, which is caused less because of net national undercount than because of differential undercoverage by geographic location and demographic groups, results in distributional inequities that are the basis for the public support of the adjustment. If these differentials are not remedied by an adjustment, such a procedure would find little popular support.

I want to make some comments about the practical nature of dealing with a decision to adjust the count and how it affects the process.

Mr. GARCIA. Please let me interrupt. There is a vote pending, and I feel you are going to be more than 5 minutes more. So I am going to recess for about 10 minutes. I will just run over, vote, and I will come right back.

So we will stand in recess for 10 minutes.

[Recess.]

Mr. GARCIA. There probably will be another vote within the next 20 to 25 minutes, so if you can bear with me, we will just keep running back and forth.

Mr. Carlucci.

Mr. CARLUCCI. Thank you. I wanted to talk about the practical nature of an adjustment and how such a decision would affect the process. Because I believe that the result of such a decision made too early and possibly simply the fact that such a decision is going to be made could produce a serious negative effect on the census process. I base that on experience.

In 1980, the Bureau proposed various methods and programs for the States to participate in a complete count, and at the same time this discussion was going on. Many areas of the country did not participate in those programs at all, and for those that did, the results were certainly much less than were hoped for. In New York, the cochairman of the task force, Assemblyman Miller, was very interested in the enumeration, supporting the enumeration, and the problems that New York has with getting a complete count, so he introduced legislation. And as a matter of fact, he wanted to come today to attend the hearing; unfortunately, we are preparing to go back into session to deal with tax changes should they happen and he was not able to attend. But he was concerned enough at the time to introduce legislation to support the efforts of localities and to coordinate their efforts in supporting census enumeration.

The legislation was supported by many of the legislators, the city of New York, and had support in both Houses, but the bill was never passed. At the same time the discussion of the undercount had produced a number of very positive articles in the press. And in response to a New York Times article, Assemblyman Miller wrote to them and urged that adjustment be considered apart from the regular enumeration process and that it not detract from the effort to achieve an accurate count.

Now, of course, the reaction is that it wouldn't happen. Everyone says that that will not be the result. In fact, in response to one of our pleas for help to one of our senior Members of Congress he identified quite clearly that there would be an adjustment and that we therefore did not need to participate at the level we were proposing in improving the count on a local level. We had an extensive discussion with him regarding this, and he never changed his position. He is still a member, and I see no reason for him to react differently today than he reacted then.

The suggestion that a greatly expanded emphasis on reducing or eliminating the undercount is something everybody agrees with, but we see very little effort expended to support it. The prospect of increased funding, expanded population, shared responsibility, are extreme measures. It creates a debate but little action.

Eventually, when enumeration is just around the corner because the stakes are so high, the activities of the census will attract the attention of the public and the press. By that time, the only possible action will be for many politicians and localities to try to push for a favorable adjustment. I realize that the Bureau is trying to structure a procedure that will prevent that. It will end up in the courts. The result will be that the court will ultimately have to make a decision on those numbers, and, as we have heard today, both the adjusted numbers and the original counts will be released, and that will radically change the perception of the census as well as the perception of the Bureau. It will also change the reapportionment process, and I can't tell you what the result would be.

Thank you.

Mr. GARCIA. Thank you, Mr. Carlucci.

[The statement of Mr. Carlucci follows:]

TESTIMONY OF
DR. CARL P. CARLUCCI

I would like to thank the Subcommittee for inviting me to testify on the subject of the decennial census undercount of population and adjustment procedures for the 1990 Decennial Census. As Executive Director of the New York State Legislative Advisory Task Force on Reapportionment I was actively involved in New York State's efforts in support of the 1980 enumeration and have participated in the discussion of both the impact of the undercount and of an adjustment. Listening to the discussion of adjusting the census I hear two very distinct and different questions being asked. The first is "should we adjust the count" and the second is "can we adjust the count?" These are both important questions and deserve to be treated separately.

SHOULD WE ADJUST THE 1990 CENSUS?

Over the years the work of professional demographers and statisticians has improved the quality of our census and increased the public's awareness of the undercount problem. With the publication of AMERICA'S UNCOUNTED PEOPLE in 1972, COUNTING THE PEOPLE IN 1980, and THE BICENTENNIAL CENSUS the undercount problem has been analyzed and adjustment consistently recommended, but each publication recommends different forms and includes a different set of reservations.

Specifically, in COUNTING THE PEOPLE the National Research Council's Panel on Decennial Census Plans identified the decision to adjust the census count as a policy decision and the implementation as a technical procedure (1). The Panel recognized that the decision to adjust the census count is a policy decision because of its political and legal ramifications, and because any adjustment procedure would lead to even more challenges to the census results and could delay the release of acceptable data. The Panel's conclusion that no adjustment methodology "would clearly be superior technically" dismissed the notion that the decision to adjust could ever be a purely technical one (2). Adjusting the census count will almost certainly change the public perception of the decennial census, making a decision to adjust tantamount to a change in our basic notion of the census and the basic mission of the Census Bureau.

What would be the impact of an adjusted count? There is a substantial body of knowledge on how it changes the distribution of federal dollars to the states, but the impact of an adjustment on congressional and state legislative reapportionment is not as clear. The distribution of funds is an administrative process, it goes on continuously, changes can be made repeatedly and in small amounts, and it can be corrected by administrative action. Apportionment is a

once-in-a-decade decision, involving large indivisible units, seats, and requires legislative and court approval. Funding is by its nature quantifiable and easily subject to statistical analysis and adjustment; apportionment is not.

According to the work of Jacob Siegel (1975), analyzing the impact of a population adjustment on the apportionment of congressional seats, the impact nationwide would be small. But what about at the sub-state level? The undercount is not uniform across or within states and applying Siegel's methodology can produce different results if varying assumptions as to undercount rates are used (Carlucci, 1980). While Siegel estimated that there would be a shift of only two congressional seats and little or no change in state legislative reapportionment, he uses average underenumeration rates with no variation for communities and makes no attempt to deal separately with the white-Hispanic population. Siegel states that rates are not uniform and are higher for minority populations and probably for urban areas.

While the apportionment of Congress could be carried out with only national and state populations counts, the drawing of district boundaries requires counts for small geographic areas. A one percent population deviation standard for congressional districts of 500,000 makes a small area of 5,000 persons significant (3).

Congressional redistricting requires block level data to meet population equality standards. State legislative districts have been given more latitude by the court, but state constitutional rules require levels of accuracy that make block-level data necessary

Sub-state counts must be precise and agree with state totals. An adjusted census must produce accurate, reliable sub-state counts that both the public and the courts will accept. The acceptance of an adjusted census count by the court will only happen when the Census Bureau can produce small area data that use a methodology and produces a result accepted by the census user communities. If the result of an adjustment creates two counts, a population count and an adjusted count, challenges to the use of either will spring up and the court, out of necessity, will start determining population. If the Census Bureau attempted to issue one count for reapportioning the House of Representatives and an adjusted count later, which would states be expected to use in redistricting House seats and their own legislatures?

The history is clear regarding the responsibility of the decision to adjust the 1990 census count. In 1978 the Panel on Decennial Census Plans recommended that the adjusted count NOT be used for reapportionment (4). In 1985 The Panel on Decennial Census Methodology recommends that there be only one count, but that "adjustment be

implemented if there is reasonable confidence that it will reduce differential coverage errors (5)." At a later point the Panel on Decennial Census Methodology suggests that time pressures will make it impossible to have an adjusted count available for the reapportionment of the House of Representatives and a difficult choice will be made. The Panel concludes that the Census Bureau should not make this choice and in fact Congress should (6).

CAN WE ADJUST THE CENSUS?

It is clear that there are a number of well developed methodologies available to adjust the census. Also, there is no question as to how we should make technical decisions regarding the development of an adjustment program and administration of the results of a census adjustment. All recommendations identify the Census Bureau and its outstanding professional staff as responsible for this operation. The Census Bureau is continuously monitored by an aggressive community of academic and professional census users who comment on every technical decision the Census Bureau makes, both as outside reviewers and as invited advisors to its staff.

The examinations of various adjustment methods conducted by the National Research Council and the Census Bureau do raise questions regarding the application of such methodologies and their results. The complexity of the methodologies proposed is second only to that of the

actual enumeration and generates differing opinions among expert statisticians and demographers. I am not expert in these fields, but I will offer an opinion because the accuracy of various methodologies and the possible scope of the adjustment are not only questions of accuracy, but of fairness.

Estimates of the undercount and the methodologies to adjust are based on data and assumptions that are subject to error. It is clear that alternative methods for adjustment can produce significantly different results. Any adjustment will likely improve the accuracy of the count for some populations, and resulting allocations, and thereby decrease the allocations to other populations (Spencer, 1980).

The Panel (1985) believes that decisions on methodology should include a consideration of the purposes which the census enumeration, and any adjustment, are intended to serve. The Panel does not provide clear criteria for evaluation or selection of a methodology, leaving the Census Bureau to attempt to make a determination largely on technical grounds. As a matter of policy, any determination must be based on the degree to which these purposes are served.

Each state, if not individual communities, is likely to develop its own calculation using sub-state data if adjustment is attempted, regardless of the methodology or

results. Individual jurisdictions will not agree with the Panel's position that "A jurisdiction's gain or loss of funds or political representation due to error is understood to be always a nonnegative loss from society's point of view (7)." Furthermore, it is the fact that the undercount, which is caused "less because of net national undercoverage than because of differential undercoverage by geographic location and demographic group," results in distributional inequities that are the basis for the public support for adjustment (8). If these differentials are not remedied by an adjustment such a procedure would find little popular support.

The methodologies under consideration all appear to suffer from the same shortcoming. These procedures work best for those people with the highest probability of being counted. Those who are most often missed will still be missed. Central cities with large minority populations typically have the highest gross omission rates. These populations are most likely to be missed in a mailout-mailback census. In addition low income individuals are less likely to generate the paper trail that would lead to their location or the accurate estimation of their numbers.

That there is an awareness of this lack of uniformity and the need for adjustments to be tailored to local characteristics is not enough. The test of the acceptability of any methodology is the extent to which it

adjusts for members of "hard-to-count populations."

HOW WILL AN ADJUSTMENT AFFECT THE 1990 ENUMERATION?

Of a more practical nature is the question of how a decision to adjust the count will affect the census process. I suggest that the result of such a decision, either made too early or even offered as a solution to the undercount problem, would produce a serious negative effect.

In 1980 the Census Bureau proposed various methods and programs by which the states could support the work of the Census Bureau in achieving as complete a count as possible. At the same time the discussion of an adjustment was raging.

Many areas of the country did not even participate in the Census Bureau's Local Review program and the results of the program overall were far less than hoped for. In New York, Assemblyman Melvin Miller, co-chairman of the body charged by the state legislature with monitoring census activities in New York in preparation for the 1990 reapportionment, introduced legislation to support and coordinate the enumeration support and outreach programs of localities (9). While the legislation was supported by many legislators and the City of New York, the bill never passed.

In 1980, in response to a February article touting adjustment, Assemblyman Miller wrote to the New York Times and urged that adjustment be considered apart from the regular enumeration procedure, so that it would not detract from an effort to achieve the most accurate count possible. Of course the reaction is that no such thing is intended and would never be the case. In fact, in response to our petition for help to one of the senior members of the New York Congressional delegation, we were told that an adjustment was imminent and was much preferable to investing time and money on improving the basic count.

The solution is a greatly expanded emphasis on reducing, if not eliminating the undercount. This suggestion evokes nods of agreements and some laughs, but little serious action. The prospect of increased funding, expanded participation, shared responsibility or extreme measures leads to endless debate, but little or no action.

Eventually, when the enumeration is just around the corner, because the stakes are so high, the decennial census machine will attract the attention of the public and the press. By that time the only possible action many politician and localities will be able to take is to push for a favorable adjustment to the census count for their area. The pressure on those making the adjustment calculations will be enormous. The result will surely be a court challenge of incredible proportions. Given the

shortage of funds and the existing conflicts that threaten the 1990 census effort, I question whether or not the Census Bureau, the future of the decennial census, and the nation's confidence in our census could withstand such a challenge.

Notes.

1. NRC, 1978, p. 111.
2. NRC, 1978, p.105.
3. Wollock cites a "de minimis" rule which has been interpreted as 1% or less by 80% of the States (Grofman, 1985, p. 84).
4. NRC, 1978, p.112.
5. NRC, 1978, p.278.
6. NRC, 1985, recommendation 7.6, p: 297.
7. NRC, 1985, p. 279.
8. NRC, 1985, p. 280.
9. New York State Assembly, 1980 Legislative Session, Bill No. A.8858-A

Mr. GARCIA. Dr. Ericksen?

**STATEMENT OF EUGENE P. ERICKSEN, ASSOCIATE PROFESSOR,
DEPARTMENT OF SOCIOLOGY, TEMPLE UNIVERSITY, AND SPECIAL
CONSULTANT, NATIONAL ECONOMIC RESEARCH ASSOCIATES,
INC.**

Dr. ERICKSEN. I am very happy to be given the opportunity to testify before you. I have submitted my testimony along with an article, "Estimating the Population in a Census Year," coauthored with Joseph B. Kadane, which expands upon the views in my testimony.¹ I would like to summarize my points very briefly because some of them have been made by other speakers.

One is that an important feature of the error in the census is that it is systematic. By design and as implemented, like any good survey, the census is designed to count those whose homes are clearly recognizable as residential structures at identifiable addresses, who are willing to cooperate with the Government by providing the requisite information, who are sufficiently well educated and proficient in English, and who are members of a well-defined family unit. When these conditions are not met, the likelihood of census error is greater. This situation has existed for every census and going back as far as 1940 it has been evaluated. Every time we find the same result. Blacks are undercounted at a higher rate than whites. In 1980, because of advances in evaluation methodology, we also learned that Hispanics are undercounted at rates similar to blacks and that blacks and Hispanics are missed at higher rates when they live in central cities like New York City and Chicago than when they live elsewhere.

Now, in 1970, according to demographic analysis, the differential between the black undercount and the nonblack undercount was 6.1 percent. In 1980, by the same analysis the differential was 5.9 percent. I don't believe that it is possible to develop a census-taking methodology which will eliminate that differential given the rules of a free society that we have here in the United States. As I see it, we have two alternatives to get the count right. One is the coverage improvement alternative. According to the General Accounting Office, \$342 million were spent to improve coverage in the 1980 census. The National Academy of Sciences evaluated special programs which cost \$100 million and they found the following results:

Twenty-eight million dollars were devoted toward improving address lists. These procedures got favorable results as 16.4 million people were added to the count as a result of those procedures. That comes to \$1.71 per capita. However, for coverage improvement procedures that were implemented during the data collection process itself, according to an NAS panel \$69.7 million were directed toward that, 2.6 million people were added, that is over \$26 per added person. That is not a cost effective way to budget for a census.

Available methods for adjustment exist and the Bureau has used them in the past. To give you one example, I have done a great deal of research on methods of calculating postcensal estimates for

¹ Retained in hearing file.

revenue sharing and other purposes. These are ways in which the census count is adjusted, hopefully to take into account changes in population and income since the census count. The technical issues involved in calculating those estimates are no easier, probably harder, than the technical issues involved with adjustment. Somehow the political situation is different so that the technical scrutiny which is applied to the adjustment situation is not applied to the calculation of these estimates.

I believe that the Director of the Census Bureau for the 1980 Census, Vincent Barabba, summed up the situation quite succinctly when he wrote, as follows:

If, in fact, the Bureau does all of the things it plans to do, and the enumeration is still differential, then the dilemma arises. The decision about what you do in that case is a political decision.

Now I believe that many of the important political decisions will be made now. This is because, as the Census Bureau has stated many times, there is a long period of time that is needed for planning purposes. The important funding decisions will be made soon, and the Census Bureau should be given all the money that it needs to develop an adjustment program. Money is better spent on developing a methodology for good adjustment now than toward the illusory goal of coverage improvement in 1990. The Congress should make it clear that the adjustment methodology has its mandate and, indeed, that the Congress expects an adjustment to occur in order to get the final count correct.

Now I would like to make a couple of comments to respond to things that were said, if I may, by a couple of the previous speakers. I think that a couple of the points that Mr. Carlucci made, I would not exactly say the same thing that he did. It is my understanding of the PEP methodology that it is designed in a way that it can calculate separate estimates for Hispanics and for different types of communities.

Second, in my view, the adjustments that are made are conservative. It is true that the current population survey and probably the post-enumeration survey in 1990 will miss the same kinds of people that the census misses. However, the adjustment that is made on the basis of those people who are found will go sufficiently far in the right direction to make a useful difference.

Finally, I would like to say that in terms of the litigation it is not easy for a locality to bring a lawsuit against the Census Bureau. In my view, if the Census Bureau has a professionally acceptable adjustment strategy, that will stand up in almost any court in the United States. The courts give the Census Bureau a great deal of discretion.

Thank you.

Mr. GARCIA. Thank you, Dr. Ericksen.

[The statement of Mr. Ericksen follows:]

TESTIMONY OF EUGENE P. ERICKSEN
TO BE GIVEN BEFORE THE HOUSE COMMITTEE
ON POST OFFICE AND CIVIL SERVICE,
SUBCOMMITTEE ON CENSUS AND POPULATION,
JULY 24, 1986

My name is Eugene P. Ericksen. I am a survey statistician and social scientist with over 20 years experience of working with census data. Currently, I am an Associate Professor in the Department of Sociology at Temple University and a Special Consultant to National Economic Research Associates, Inc. I am also a co-author, with Professor Joseph B. Kadane, of the paper, "Estimating the Population in a Census Year," published in 1985 in the Journal of the American Statistical Association. This paper, which I submit along with this testimony, describes my views concerning methods of data collection and estimation on the Decennial Census. I respectfully also refer the subcommittee members to other testimony which I have submitted to the subcommittee on this subject on other occasions.

I am here to make three points: (1) that regardless of how much money and effort are expended on the traditional headcount, a differential undercount is inevitable in the American Census; (2) that coverage improvement procedures, aimed at simply redoubling traditional headcounting efforts, do not solve the problem and indeed can

increase the amount of error in census data; and (3) that methods of estimation exist by which an imperfect census can be adjusted to bring the count closer to the truth. I conclude that for the 1990 Census, we should direct funds toward the development and implementation of appropriate adjustment techniques rather than toward so-called "coverage improvement".

1. Error in the Census Is Inevitable

The Census is a survey that provides and can only provide an estimate of the true population. It is inevitably fraught with error in the collection of data that necessarily results from census procedures. Inequity occurs when, as is invariably the case, the errors are greater in some places than others. In the United States, errors due to undercounting are greatest in central city neighborhoods inhabited by minority populations. These errors have caused these cities and their states to be shortchanged in terms of political representation and fund allocations.

Problems giving rise to error beset any attempt to collect survey data. Such problems are present in magnified form in an undertaking as massive as the census. This is especially true because the majority of census workers at many levels are temporary employees without prior experience in collection of data. At peak periods during the 1980

Census, the Bureau employed about 275,000 temporary employees in its field offices and about 6,300 temporary employees in its three specialized processing centers. It is extremely difficult to find people qualified to be enumerators in poor urban areas, and the time and funds available to train them for the job are limited. Quality control problems inevitably cause errors in census data as the Bureau itself has recognized in evaluation studies that follow the Decennial Census (e.g., ER-60 Series after the 1960 Census, PBC(E) Series after the 1970 Census, and PBC-80 Series after the 1980 Census).

An important feature of the errors in the Census is that they are systematic. By design and as implemented, the Census is best suited to count those whose homes are clearly recognizable as residential structures at identifiable addresses, who are willing to cooperate with the government by providing the requisite information, who are proficient in English, who are educated and who are members of a well-defined family unit. Where those conditions are not met, the likelihood of census error is greater. Problems can be identified at each step of the census process.

The first step is the preparation of address lists. In urban areas the Census Bureau relies on commercial address lists which it then updates through field checks. A study by the General Accounting Office has shown

that the commercial lists are much worse in poor central city neighborhooda than they are elsewhere. Updating the lists through field checking is also difficult in these neighborhooda, which are often dangerous and in which multiple housing units at the same address are frequently dia-guiaed and hard to spot without contacting the residents.

Additional errors occur when census forms are mailed to thoee addressees included in the listings. In order for a household to receive a form, it must not be lost in the mail for any reason. The mailing label must be affixed properly, the address must be legible, and the form must be handled properly by the Post Office. In apartment buildings or other multi-unit structurea where mail is received collectively, the residents must distribute the questionnaires correctly among themselves for each household to receive its form. In areas like the South Bronx, where there were thousands of broken mailboxes and where the questionnaires often did not include the name of the addressee as part of the mailing address, many people did not receive census forms in 1980.

Assuming a questionnaire is received, someone in the household must open it, answer it correctly, and return it to the Bureau. The questionnaire may go unopened or it may be opened but then lost. The questions may not be understood by the respondent and thus may be incorrectly

answered, particularly if the respondent is poorly educated or if the respondent's native language is not English. Even if the questionnaire is correctly answered and mailed back, it may be lost in the mail. Assuming the form is received by the Census Bureau, it must be correctly recorded and tabulated. Inevitably in this process, forms are lost or destroyed and the data on some are misrecorded or mis-tabulated.

If the household does not return the form, an enumerator is sent to visit the address and attempt to collect the form. Depending on the crime rate and ease of finding the address in the area, this is a job of varying difficulty. Where the mailback rate is higher, this job is easier. While a low mailback rate does not mean that people inevitably will be missed, it certainly makes it more likely because the job is so much harder. The task was substantially more difficult in the Bedford-Stuyvesant area of Brooklyn, where fewer than half the population mailed back their census forms, than in a middle-class suburban area where the mailback rate was 90 to 95 per cent.

In some cases, the enumerators are not able to find any household residents. In such instances, the enumerator is told to seek out a neighbor, building janitor, or similar outside source to obtain information about the unit. Such people have imperfect information, and less than

ideal motivation to supply it. Moreover, many enumerators, perhaps in frustration, simply "invent" their own information in a well-known procedure called "curbstoning". Finally, the quality of the follow-up, like the quality of the address lists, is adversely affected by the use of a large number of temporary employees as enumerators.

The foregoing points are not made in criticism of the Census Bureau, but merely to show that it is impossible accurately to count every person and that it is the most disadvantaged members of our society who, by the nature of the Census, are the ones predominantly missed. Indeed, the Census Bureau recognizes the existence of most of these problems, and has attempted to remedy them. The remedies, however, are themselves imperfect solutions. Since these imperfections are most likely to result in errors in situations where it is most difficult to count people, the errors are cumulative. It is a general principle of survey research that checks need be made at every step of the process of data collection. This means checking the completeness of the address list, making sure that all forms are returned, checking the validity of data on every form, and making sure that all data are correctly processed through the computer. As the data base grows larger, the proportion of resources needed to be devoted to quality control grows larger. When the survey attains the size of a

Decennial Census, the task of complete quality control becomes monumental.

2. The Geographical Distribution of the Undercount

The Census Bureau evaluated the undercount by means of its Post Enumeration Program (PEP) in 1980. Best estimates indicate that 10 to 13 million persons were omitted from the Census, 6 million others were erroneously enumerated and 3 million additional person-records were created by computer by a method known as imputation. This resulted in a net national undercount of 1 to 4 million persons, concentrated in central cities. The PEP produced separate estimates for 16 large central cities like New York and Chicago. In these cities, the combined omission rate was estimated to be 9.9 per cent, compared to 5.0 per cent elsewhere. The rate of erroneous enumeration was 2.6 per cent, comparable to the 2.9 per cent observed elsewhere. The net result was an undercount of 6 per cent in the cities and 1 per cent in the rest of the country. As shown in the table below, the differential undercount was especially great for Blacks and Hispanics, who were missed at rates exceeding ten per cent in the cities.

The 1980 Census was the first one for which this type of geographic detail was presented on the undercount. However, the racial pattern is similar to that observed on

censuses since 1940. For example, in 1970 the Bureau used demographic methods to estimate an undercount of 7.6 per cent for Blacks and 1.5 per cent for Whites, a differential of 6.1 percent.

Undercount Rates for Three Ethnic Groups
in Central Cities and Elsewhere, 1980

<u>Location</u>	<u>Group</u>			<u>Total</u>
	<u>Blacks</u>	<u>Non-Black Hispanics</u>	<u>Other</u>	
Central Cities	11.3%	10.3%	1.5%	6.0%
Elsewhere	5.5%	4.5%	0.2%	1.0%
Total	7.2%	5.9%	0.3%	1.6%

The racial differential for 1980 as measured by demographic analysis was 5.9 percent, a scant improvement. It is this differential which is so intractable, resisting the best efforts of the Census Bureau to obtain complete and equitable counts. On the basis of the results for 1980 and earlier years, we can expect the same pattern of differential undercounting to occur in 1990 and later.

3. Coverage Improvement Campaigns Do Not Solve the Problem

The 1980 Census was by far the most expensive in American history. According to a report of the General

Accounting Office, the inflation-adjusted cost of counting one person in 1980, \$4.72, was more than twice the 1970 cost, \$2.30. According to a panel of the National Academy of Sciences, approximately \$100 million was invested in a variety of coverage improvement programs, a substantial increase over the \$13 million (1980 dollars) spent in 1970. The panel concluded that coverage improvement programs directed toward improving address lists improved the count in a cost effective manner, as 16.4 million people were added at a cost of \$28.1 million, \$1.71 per capita. However, coverage improvement programs attempting to add population during the data collection period were less effective, as only 2.6 million people were added at a cost of \$69.7 million, \$26.81 per capita. There were at least two reasons for this negative result.

One is that Census Bureau personnel, already overwhelmed by the routine tasks of data collection and tabulation, simply had no time to carry out the coverage improvement procedures correctly. This is illustrated by the Nonhousehold Sources Program in which lists of licensed drivers and welfare recipients were supposed to be compared to census registers, with omitted persons added to the count. An evaluation by the General Accounting Office found that this program was usually not fully implemented. The

NAS panel found that only 130,000 persons were added at a total cost of \$9.8 million \$75.54 per capita.

A second problem arose from the Bureau's policy regarding sampling. In 1970, the Census Bureau carried out a National Vacancy Check in a sample of 13,500 vacant housing units. It found that 8.5 per cent were in fact occupied, so the Bureau randomly changed a corresponding proportion of all vacant housing to the status of "occupied." Just over one million persons were added to the count at a per capita cost of 21 cents. In 1980, the Bureau decided that sampling procedures should not be used, and carried out the National Vacancy Check on all housing units initially listed as vacant. Here, 1.7 million persons were added, but at a per capita cost of \$21.12, one hundred times the corresponding cost in 1970.

There is ample evidence that, in addition to its failure to reduce the omission rate substantially, the coverage improvement programs caused erroneous enumerations to increase. For example, without a corresponding check of households initially classified as "occupied" the National Vacancy Check was bound to inflate the count. The NAS Panel found that several coverage improvement programs could cause erroneous enumerations, and this is consistent with the results of two Census Bureau studies.

The first, a study of housing unit duplications, found that approximately two million people live in housing units that were counted twice, often in rural areas where enumeration district boundaries are less clear and street addresses lacking. The second, a more comprehensive estimate of erroneous enumerations, found that they were much more likely to occur on follow-up activities than on the initial mailout-mailback. Among persons counted during the follow-up period when enumerators collected the data, one in fourteen turned out to be erroneous enumerations.

There are many potential explanations for this high rate of error. One is that the period of data collection lasts so long, stretching into the fall of 1980 in many areas. Given the high mobility of the American population, the same family could be counted twice in different places (either because it moved or had two residences) with the family being unaware of it because information was provided by different family members or by neighbors. Another explanation is simple fabrication, occurring when enumerators are under great pressure to get forms completed to meet Bureau deadlines.

4. Adjusting the Counts

The Bureau's studies show a consistent pattern of undercounting, with Blacks and Hispanics missed at higher rates than Whites, and with minorities living in central cities missed at higher rates than minorities living elsewhere. The extensive and systematic nature of the undercount consistently shown by the Bureau's own studies makes clear that adjusting the count will improve the accuracy of the results. Indeed, the Census Bureau has itself used adjustment in other contexts. For example, the methods used by the Census Bureau to calculate post-censsl estimates of population and per capital income involve the same matching, regression, and demographic estimation methods Professor Kadane and I have advocated for adjusting the Census. Moreover, when in 1970 the Census Bureau needed to adjust Census estimates of per capits income for very small places, it used the same regression method described in our psper.

Much of the reason the Census Bureau hesitates to adjust the Census for the differential undercount is political. As Vincent Barabba, Director of the Census Bureau during the 1980 Census, said:

"If, in fact, the Bureau does all of the things it plans to do, and the enumeration is still differential, then the dilemma arises.

"The decision about what you do in that case is a political decision." ("A Right to be Counted", American Demographics 44 at 46 (1979))

The Census has been taken without adjustment for the disproportionate undercount for 200 years, and with all the scrutiny focused on the count, the Bureau hesitates to make a change unless it feels it has the clear blessing of Congress.

The Census Bureau has not directed sufficient research effort toward developing good adjustment methods, and it is likely that current and future research can be very fruitful. As Barbara Bailar, the Associate Director for Statistical Standards of the Census Bureau stated in the New York trial, "We have been doing matching studies off and on over a period of 30 years . . . I think if we had been working on matching and really devoting all kinds of research necessary to learn how to do matching well, we would probably be a lot further ahead." In my opinion, money allocated by the Congress to further these research efforts would be money well spent.

5. Conclusion

I draw two conclusions from the foregoing:

- (1) that it is foolhardy to invest large sums of money toward the illusory goal of coverage improvement; and
- (2) that the Congress should give a clear mandate to the

Census Bureau to make its best estimate of the population, which will necessarily require an adjustment. Indeed, Congress should make clear that the Bureau's failure to correct for differential undercounting would constitute a failure to perform its responsibilities.

We have learned from the 1980 Census that regardless of the amount of money invested in coverage improvement, millions of people will be omitted, and that these people are likely to be Black, Hispanic, and live in cities. The problem is made worse by the fact that coverage improvement procedures cause additional errors to occur, further reducing the quality of the data.

Demographic analysis makes it plain that Blacks are missed at much higher rates than nonBlacks. Survey results make it clear that Hispanics are missed at rates similar to Blacks, and that persons living in central cities are much more likely to be missed than persons living elsewhere. Any reasonable adjustment shifting population shares into these central cities will produce a more accurate and equitable estimate of America's population distribution, and hence will improve the situation. It is time for the Congress to assure that the next Census will be significantly more cost-effective and accurate than those of the past.

Mr. GARCIA. Mr. Joseph Waksberg.

STATEMENT OF JOSEPH WAKSBERG, VICE PRESIDENT, WESTAT,
INC.

Mr. WAKSBERG. Thank you, Mr. Chairman.

For at least the last four decades, the Census Bureau has carried out programs that evaluated the quality of the decennial censuses and provided most of the available information on the undercount. Other speakers at today's hearings are discussing the relationship of evaluation to adjustment. I am concerned that the attention to adjustment procedures may erroneously create the impression that the sole or primary purpose of evaluating census data is to assist an adjustment and that if adjustment is not planned, then there is no need for an evaluation program. It would be unfortunate if a decision is reached on the conduct of the 1990 census based on this line of reasoning.

There are good reasons why censuses were evaluated long before the recent drive to adjust the census results and they still apply. I would like to describe the purposes of census evaluation and research programs, the uses to which they have been put and future needs for comparable research.

Evaluation and research programs have three major objectives. The first is to provide information to the Bureau staff on the kinds of errors arising in censuses and the cost effectiveness of potential methodological improvements. Second, to provide to users of census data estimates of errors for their knowledge in understanding the strengths and the limitations of census data. And third, to conduct experiments and analyses that evaluate specific procedural steps and devices. It should be noted that there are many experiments that can only be carried out during the course of a census, either because they require very large sample sizes which are only available in the census or they involve public perception which is affected by the publicity and other forms of public education during a census.

I would like to illustrate the importance of the practical applications of the research with examples of specific major uses of past research. The list of examples I will give is far from exhaustive. I have selected the more important uses of research, with particular attention to the ones with which I am personally familiar. Other examples and more detailed information on the ones I will mention are included in my written testimony.

First, let me go on to the impact of evaluation and research on the methods used in taking the census itself. Since 1950 there have been fundamental changes in the methods of census taking, based largely on analyses of prior research. Virtually all of the many specific procedures introduced in 1960 or later are direct outgrowths of lessons learned in evaluation studies. Let me give some examples.

One of the key elements in current censuses is the use of self-enumeration. Reliance on self-enumeration was first introduced in 1960, and it was a direct outgrowth of what was learned from a 1950 research study referred to as the Enumerator Variance Study, as well as two other experiments. The attempt to increase the level

of self-enumeration was a major motivation in developing plans for a mail census.

In connection with coverage improvement, earlier evaluations indicated that in spite of all attempts to improve the completeness of the count in conventional types of censuses, it was still at an unsatisfactory level. This led to research on alternative methods of improving coverage, including establishing an independent mailing list for mail census, using the post office to update and correct it, and other similar methods.

Similar analyses were involved in the choices of coverage improvement programs used in the 1980 census. A variety of methods were introduced in 1970 and were intensively studied in the 1970 evaluation program. The effectiveness of each method was an important ingredient in the development of the 1980 coverage improvement program, especially in the determination of the geographic scope of these programs.

Another illustration is the continuation of the collection of data on a sample basis. The 1950 census was the first one to rely significantly on sampling for the collection of basic data formerly collected in the complete census, and also for the preparation of detailed tabulations. However, there were a number of restrictions that were imposed on the determination of what items could be collected on a sample basis. The decision to expand sampling in 1960 was essentially based on analyses of the 1950 data. The extensive use of sampling was retained in 1970 and 1980. Sampling permitted sizable reductions in costs and in the time needed for the preparation and publication of census reports.

Evaluation programs indicated the need for changes in the wording of questions for such major items as labor force, educational attainment, and other subjects. The revised formats for these items have been adopted as the standard in most private statistical organizations as well as the Bureau's current surveys.

Evaluation data are also used as a standard to test whether anticipated advantages from changes in procedures actually materialize. For example, the 1960 results on coverage were an essential factor in assessing whether the test studies of the mail-out/mail-in census procedure for 1970 produced hoped for improvements in quality.

Let me go on to uses of the research and evaluation studies by users of census data. The results of the evaluations of past censuses have been widely distributed by the Census Bureau and are commonly used by serious analysts in interpreting statistical data. The research program has also had an important effect on statistical methods used by other statistical organizations, both government and private, in the United States and abroad. I will give some examples.

First of all, let me point out the importance of the evaluation data in keeping congressional oversight committees such as yours apprised of what is going on in the censuses. Evaluation data are essential in keeping Congress informed about the quality of each census and whether funds allocated for improvements in census methods are having their desired effects. I find it difficult to visualize how the subcommittee could carry out oversight functions effectively in the absence of data on the quality of the census from the

evaluation and research programs. I should also note that because of the widespread use of census data for Federal fund allocation, other congressional committees are also concerned with and have raised questions about the quality of census data.

Another important group of users are persons concerned with vital statistics data. Birth rates and death rates in the United States are calculated by using birth and death registration data as the numerators in the computations and census counts as the denominators. Errors in the denominators can distort the results as well as those in the numerators. The National Center for Health Statistics, which prepares and publishes vital statistics data, indicates to its users the importance of using census evaluation data in interpreting the results.

Census Bureau analysts are themselves important users of evaluation data. The Census Bureau regularly updates the census population counts for the United States in its intercensal population estimates program. They produce updated figures every year—in fact, every month.

For a number of technical reasons, the census counts are first adjusted for underenumeration during the preparation of the estimates and later reduced by equivalent levels. The procedure is referred to as inflation and deflation.

Data on undercounts also enter into the projections of the population in future years made both by the Census Bureau and other agencies. Some of the projections have critical policy implications. For example, Social Security Administration's estimates of the aged during the next 50 years is a major input in determining Social Security programs, and even small errors may have serious implications.

The monthly statistics on employment, unemployment, and related labor force items are anchored to the Census Bureau's intercensal population estimates by age, sex, and race, as are annual data on education, migration, fertility, income, and almost all other Census Bureau social statistics. Undercount estimates are thus involved in virtually all of the Bureau's population estimates.

Other organizations involved in the collection of statistical data, including universities, market research firms, those in public opinion measurement, and government statistical agencies in other countries, have all benefited from the research that was an outgrowth of the census evaluations. The results of the research have affected statistical methods in a wide variety of areas, including question wording, geographical classification, data processing, computer systems, as well as the methods of data collection carried out by these organizations. As an example, it can be noted that the Bureau was the first statistical agency to experiment with and make use of computers for data processing and with an automatic data entry system. This revealed the potential and versatility of instruments that have become standard tools and are now taken for granted.

Let me make a few final comments. I have attempted to describe major uses to which the Census Bureau's research has been put in the last two or three decades. There is, of course, no assurance that the research conducted in 1990 or future years will have the same impact on statistical methods as the studies that have been carried

out in the past. However, one should not take the attitude that nothing further needs to be known about the conduct of censuses. The Census Bureau is staffed with competent statisticians and it is reasonable to assume that they will continue the Bureau's long tradition of being in the forefront of statistical methods.

I must say I was somewhat hesitant about appearing before this committee to defend research. It seemed almost self-evident that in our stage of society, a large organization cannot afford not to conduct research. The industrial companies that have gone out of business because they have not kept abreast of the latest technology provide ample evidence of the need for research. However, I realize that when there is pressure of impending budget cuts there is always a temptation to sacrifice the future for the present, and I thought it would be useful to remind the committee of the shortsightedness of such a policy.

Mr. GARCIA. Thank you very much.

[The statement of Mr. Waksberg follows. Also included are his responses to written questions:]

IN THE U.S. CENSUSES OF POPULATION AND HOUSING

Presented before the U.S. House of Representatives
Subcommittee on Census and Population
July 24, 1986

Joseph Waksberg, Vice President, Westat, Inc.

1. General Purposes of Census Evaluation and Research

Today's hearing of the U.S. House of Representatives' Subcommittee on Census and Population is concerned with the undercount in past population censuses, and the potential for partially compensating for it in 1990 by adjusting the census results. In order to adjust the census figures, it is necessary to have detailed data on persons who are missed in the census. For at least the last four decades, the Census Bureau has carried out programs that evaluated the quality of the decennial censuses and provided most of the available information on the undercount. Other speakers today are discussing the relationship of evaluation to adjustment. I am concerned that the attention to adjustment procedures may erroneously create the impression that the sole or primary purpose of evaluating census data is to assist in adjustment and that if adjustment is not planned, then there is no need for an evaluation program.

It would be extremely unfortunate if a decision is reached on the conduct of the 1990 census based on this line of reasoning. There were good reasons why censuses were evaluated long before the recent drive to adjust census results, and they still apply. I would like to describe the purposes of census evaluation or, more broadly, census evaluation and research

programs, the uses to which they have been put, and future needs for comparable research.

The evaluation and research programs can be considered as having three major objectives:

1. To provide information on the kinds of errors arising in censuses and the cost effectiveness of procedures being used to the Census Bureau's staff for their use in planning future censuses. The focus here is on methodological improvements and an improved design of the total system.
2. To provide to the users of census data estimates of errors for key census statistics and related information on the components of the errors. This is primarily for their knowledge in understanding the strengths and limitations of census data.
3. To conduct experiments and analyses that evaluate specific procedural steps and devices. The purpose is the same as for the first objective, to examine ways of improving the conduct of future censuses. It should be noted that there are many experiments that can only be carried out during the course of a census, either because they require very large sample sizes which are only available during a census or they involve public perception which is affected by the publicity and other forms of public education during a census.

I would like to illustrate the importance of the practical applications of the research with examples of specific major uses of past research and evaluation programs. Before going on, I want to make some comments on my choice of examples of research effects. First, the list of examples discussed is far from exhaustive. I have selected the more important uses of the research, with particular attention to the ones with which I am personally familiar. Secondly, I have concentrated on results of research studies of population and housing censuses. Similar

examples could be provided for the Census Bureau's economic censuses, but they do not appear to be relevant to these hearings. Finally, I have paid more attention to uses made by the Census Bureau than to other consumers of the data. This is not because I believe they are more important, but because they illustrate the importance of the research more clearly.

2. Impact of Evaluation and Research on Methodology of U.S. Censuses

Since 1950, there have been fundamental changes in the methodology of census-taking, based largely on analyses of the results of prior research. Virtually all of the many specific procedures introduced in 1960 or later are direct outgrowths of lessons learned in earlier evaluation studies.

The most important of these new procedures are described in the balance of this statement. However, it should be emphasized that a list of such examples cannot adequately cover the various ways that knowledge of the strength, weaknesses and limitations of data are used in interpreting the results and in making decisions about plans for future censuses. The facts regarding the quality of statistics that emerged have become important background information for the Census staff and it is as difficult to delineate the occasions in which the knowledge is used as to itemize the uses of census statistics themselves.

Several other aspects of the evaluation programs should be noted. The first concerns the relation between recent and earlier studies. Much of the 1980 program duplicated types of information collected in previous decades. There were

essentially three reasons for the duplication: (a) At each census, the Bureau developed hypotheses on how to improve the measures of quality previously used. Consequently, the Bureau has been able to progressively sharpen the measuring tools and obtain more precise measures of quality for these items; (b) It was felt desirable to obtain readings on measures of census quality at each Census rather than to assume a constant level of quality; (c) The changes in census methods introduced at each census are expected to produce changes in quality, generally improvements. It is important to measure quality under the changed conditions, and to try to ascertain the extent to which improvements occurred.

This final reason has an important bearing on the reasons for the evaluation programs. In a sense, one of the purposes of each evaluation program is to ascertain whether the census is moving in the right direction in adopting the procedures utilized.

The second aspect is that direct implications of the results of a particular program cannot always be anticipated in advance. Some experimental studies are geared to test the feasibility of a specific change in method. However, many of the other studies are initiated purely to get background information on quality of the statistics. It is only when analysts are concerned or even shocked at some of the results that new methods are explored to overcome the weaknesses. Evaluation programs will probably always have, at least partially, the characteristic of investigating statistical quality, initially to determine if any problems exist, and then only if conditions warrant them to propose procedural changes.

Finally, the need for detailed evaluation does not imply that nothing would be known about the quality of census statistics if research using such methods as reenumerative surveys, matching, analysis of the census operations, etc., were not conducted. A considerable amount of insight into problem areas is obtained by comparison of census totals with results of other statistical systems, such as vital statistics, social security records, and earlier censuses. However, with minor exceptions, evaluation programs are the only existing devices for obtaining reasonably precise measures of the extent of gross error, the causes of error, and whether or not any progress is being made in many aspects of census methods. This knowledge permits attention to be focused on the important problems and leads to the development of improved methods.

The most important procedural devices used in recent Censuses that have developed from the evaluation programs follow:

Self-enumeration and Mail Censuses

One of the key elements in current censuses is the use of self-enumeration. Reliance on self-enumeration was first introduced in 1960. It was a direct outgrowth of what was learned from a 1950 study referred to as the Enumerator Variance Study and two other experimental projects carried out in 1950. The 1960 Response Variance Study was conducted to get a second reading on this contribution to total variance, and to ascertain whether the anticipated reduction in variance due to the use of self-enumeration really occurred. The findings confirmed the results expected, and the 1970 and 1980 Censuses were even more dependent on self-enumeration than 1960. The attempt to increase

the level of self-enumeration was a major motivation in developing plans for a mail census although, as indicated below, there were other reasons also.

Coverage Improvements through Use of Mailing Lists,
Post Offices, and Other Special Programs

Earlier evaluations indicated that in spite of all attempts to improve coverage in conventional types of censuses, it was still at an unsatisfactory level. This led to an examination of alternative methods of improving coverage. The 1960 Census contained an experiment to determine whether Post Office resources could be used to improve coverage, and a similar smaller scale study was conducted in 1957. Subsequently, the procedure of creating an independent mailing list and using the Post Office to update and correct it was developed as the basis of the mail census planned for 1970 and repeated in 1980. Once the plans for the mail census were developed, it became clear that there would be many additional advantages -- for example, extension of self-enumeration, greater flexibility in geographic coding, smaller enumerator recruitment needs, and the ability to concentrate more attention in difficult enumeration areas. However, the initial impetus was related to the facts emerging from the coverage analysis.

Similar analyses were involved in the choices of coverage improvement procedures used in the 1980 Census. A variety of methods were introduced in 1970 and were intensively studied in the 1970 evaluation program. The effectiveness of each method was an important ingredient in the development of the

1980 coverage improvement program, especially in the determination of the geographic scope of these programs.

Continuation of the Collection of Data on Sample Basis

Although the 1940 census collected a limited amount of information on a sample basis, the 1950 Census was the first one to rely significantly on sampling for the collection of basic data formerly collected in the complete census, and for the preparation of detailed tabulations. However, there were a number of restrictions that were imposed on the determination of what items could be collected on a sample basis.

In the 1960 and subsequent Censuses, the restrictions on the use of sampling were almost completely removed, and all items except those virtually required to define and count the population, and the housing items needed for block statistics, were collected on a sample basis. Three factors brought about this extension of the use of sampling:

- a. The evaluation programs -- in particular the matching of Census with current sample survey results, and the various response variance studies -- provided evidence that for most census statistics, the introduction of a moderate sampling error would have only a minor effect on the total error. This mostly came about because the reduction of response error due to the elimination of the interviewer component of response variance was sufficient to compensate for the introduction of sampling error.
- b. The sampling procedures were carried through in the field operations reasonably well. This is not to say that some biases in sample selection did not turn up. The biases, however, were not great

enough to have a serious effect on most uses of the data.

- c. There were sizeable reductions in cost and in the time needed for preparation and publication of the census report.

The decision to expand sampling in 1960 was essentially based on an analysis of 1950 data. The results of the 1960 evaluation program were examined to determine if the revisions in census methods introduced in 1960 had enough effect on the relationship of sampling error to total error to require any changes in our attitude on the use of sampling. No changes in approach to the use of sampling seemed called for, and the extensive use of sampling was retained in the 1970 and 1980 Census. As in 1950, analyses of the composition of the sample indicated some biases in the sample selection, but these were not great enough to compensate for the great gains in efficiency brought about by the use of sampling.

Selection of Households for the Census Sample

Studies made of the composition of the 25 percent sample in 1960, including an analysis of differences between sample and nonsample households, indicated the presence of some small but troublesome biases. The 1960 sample apparently had too few one-person households and too many with three-persons. Also there seemed to be shortages of secondary individuals and certain other types of household members.

One of the motivations for considering a mail census was that it permitted a largely computer-selected sample, thus

avoiding the possibility of the enumerator biasing the sample by modifying the order of listing.

Measurement of Housing Quality

In developing plans for a mail census, one of the problems that was discussed involved information on quality of housing. In 1960 and 1950 this item was based on the enumerator's visual observations of the structural soundness of the housing units. A three-way classification was used in 1960 -- sound, deteriorating, or dilapidated.

No promising method of obtaining comparable information through self-enumeration turned up in several pilot studies. At first, it appeared possible that if an alternative was not developed, a mail census might be rejected by the need for housing quality data. An analysis of the response variance for this item indicated that the enumerator's observations were completely unstable, arising from the subjective nature of the enumerator's judgments on quality. Considering the crude nature of the interviewer's measurement of this item, it became clear that obtaining accurate data on quality should not be considered a major goal of the census.

Effect of Evaluation Program on Question Wording

The evaluation programs indicated the need for changes in the wording of questions in later censuses. For example, the first test of self-enumeration and a mail census was carried out in an experimental study in 1950. The evaluation of labor-force

items in this experiment suggested that the battery of questions used to establish labor force status in the 1950 Census was not an effective device for self-enumeration. Respondents apparently would not follow correctly a skip-pattern whose logic and significance were not clear to them. On the other hand, they did skip questions which appeared irrelevant to them, even when the fine print on the questionnaire told them not to. Considerable revisions in the set of questions were made for 1960 on the basis of this analysis that led to successful collection of labor force data by self enumeration. The revisions were retained in the 1970 and 1980 Censuses.

Another example is in the collection of data on educational attainment. Evaluation of earlier censuses indicated many respondents were not clear on the distinction between highest grade attended and highest grade completed. The resulting errors in reporting were largely eliminated when the wording was altered; first a question was asked on highest grade attended, followed by a separate inquiry on whether that grade was completed. This format has been followed on all recent census and has been adopted as the standard on the Bureau's current surveys.

Use of Evaluation Results in Testing New Procedures

As discussed in previous sections, evaluation results provide measures of the strengths and the weaknesses of census data, which become the motivation for developing improved methods for conducting censuses. When these alternate methods are pretested in the field, the evaluation data become a standard of whether the anticipated advantages actually materialize. For

example, the 1960 evaluation results on coverage were an essential factor in assessing whether the test studies of the mail-out-mail-in census procedures produced the hoped-for improvements in quality. Coverage evaluation programs were carried out as part of the tests conducted between 1960 and 1970. Only by comparing the results with the 1960 coverage evaluation figures, could effectiveness of the new procedures be compared with population and housing unit counts obtained by the older census methods.

3. Needs for Evaluation and Research Results by Users of Census Data

The results of the evaluations of past censuses have been widely distributed by the Census Bureau. They are commonly used by serious analysts in interpreting statistical data. The research program has also had an important effect on statistical methods used by other statistical organizations, both Government and private, in the U.S. and abroad. Some examples follow.

Congressional Oversight Committees

Evaluation data are essential in keeping Congress informed about the quality of each census, and whether funds allocated for improvements in census methods are having their desired effects. The staff of the Subcommittee on Census and Population is, of course, more familiar with data they use to make judgments about the Bureau's programs than I am, but I find it difficult to visualize how the Subcommittee could carry out oversight functions effectively without information from the

evaluation and research program. I should also note that because of the widespread use of census data for Federal fund allocation, other Congressional committees are also concerned with the quality of census data. One of my last official duties before I retired from the Census Bureau in 1973 was to testify before the House Committee on Labor and Education. The Committee was holding hearings on a renewal of the education act which provides for allocation of funds to school districts on the basis of the number of below-poverty school children. The Committee wanted to make sure that the quality of the census figures was sufficiently high for the data to serve as a basis for allocation. Without the evaluation results, there would have been no way of replying to the questions that were raised.

Vital Statistics

Birth rates and death rates in the U.S. are calculated by using birth and death registration data as the numerators in the computations and census counts in the denominator. Errors in the denominators can distort the results. In a recent report by the National Center for Health Statistics on Mortality (Vital Statistics of the U.S., 1978, Vol. II - Mortality), there is a detailed discussion of the census undercount and its effects on rates. The appendix notes that the impact of the undercount "... can be of several types: (1) Effects on levels of observed rates, (2) effects on differences among groups; and (3) effects on the levels and group differences shown by summary measures such as age adjusted rates and life expectancy." The appendix describes how users can adjust the vital rates on the basis of evaluation data, and provides some examples of the effects. A particularly striking example given is the fact that for deaths

from homicide, "... the age-adjusted death rate for black males would decrease by 10.4 percent from 72.8 to 65.2 deaths per 100,000 population."

Preparation of Intercensal Population Estimates and Population Projections

Census Bureau analysts are themselves important users of evaluation data. The Census Bureau regularly updates the census population counts for the U.S. in its intercensal population estimates program. For a number of technical reasons, the census counts are first adjusted for under-enumeration during the preparation of the estimates and later reduced by equivalent levels. The procedure is referred to as inflation-deflation.

Intercensal population estimates using evaluation results have also been developed by other analysts. Historic data on the U.S. population by age, sex, and race based on census data that were adjusted for undercoverage, were recently prepared and described in an article in the November 1984 issue of Demography.

Data on undercounts also enter into the projections of the population in future years. Some of the projections have critical policy implications. For example, Social Security Administration's estimates of the aged during the next 50 years is a major input in determining social security programs, and even small errors may have serious implications.

Intercensal population estimates for cities, counties, and other small areas are prepared by both Governmental agencies

and commercial organizations. These data are used for a variety of purposes, such as fund allocation and determination of market share and marketing effort. Census data are virtually always key ingredients in the estimates, and the research on the undercount, on the number of undocumented aliens, and on other issues affecting the quality of the census are factors used in understanding the limitations and improving the quality of the data.

Labor Force Data

The monthly statistics on employment, unemployment, and related labor force items are anchored to the Census Bureau's intercensal population estimates, by age, sex, and race. The use of Census evaluation results in the intercensal figures are thus reflected in unemployment, employment and related labor force data. In addition, the fact that under-enumeration is not identical from census to census causes discontinuities in the labor force time series. The evaluation data are helpful in distinguishing between real changes over time, and those artificially created by the changes in census coverage.

Intercensal Population Estimates for Revenue Sharing Purposes

An illustration of an unexpected application of census research involves Revenue Sharing. Federal funds are allocated to about 39,000 local governments on the basis of a formula that includes the population of the localities. The Census Bureau regularly updates the population figures so that the allocations reflect the current situations.

During the 1960's, the Bureau started experimental work on the possibility of using Internal Revenue Service micro records in the evaluation of income and other selected census data. When the need for population updates for the many small governmental areas in Revenue Sharing arose, it quickly became apparent to Census analysts that the IRS data were the only existing source of information on migration into and out of these areas, and the IRS files became a key component of the estimation procedure. The prior research permitted a program to be developed quickly. It considerably advanced the production of the needed data, possibly by up to two years.

As a by-product of both the original research and the Revenue Sharing estimates, the methodology also improved statistics on migration that are used for many other purposes.

Census Research Uses by Other Statistical Organizations

Other organizations involved in the collection of statistical data -- including universities, market research firms, those in public opinion measurement, and government statistical agencies in other countries -- have all benefited from the research that was an outgrowth of the Census evaluations. The results of the research have affected statistical methods in a wide variety of areas, including question wording, geographical classification, data processing, as well as the methods of data collection carried out by these organization. As an example, it can be noted that the Bureau was the first statistical agency to experiment with and make use of computers for data processing and with an automatic data entry system. This revealed the potential and versatility of

instruments that have become standard tools and are now taken for granted.

4. Final Remarks

I have attempted to describe major uses to which the Census Bureau's research has been put in the last two or three decades. There is, of course, no assurance that research conducted in 1990 or future years will have the same impact on statistical methodology as the studies that have been carried out in the past. However, one should not take the attitude that nothing further needs to be known about the conduct of censuses. The Census Bureau is staffed with competent statisticians and it is reasonable to assume they will continue the Bureau's long tradition of being in the forefront of statistical methods.

I was somewhat hesitant about appearing before this Committee to defend research. It seemed almost self-evident that in our stage of society, a large organization cannot afford not to conduct research. The industrial companies that have gone out of business because they have not kept abreast of the latest technology provide ample evidence of the need for research. However, I realize that when there is pressure of impending budget cuts there is always a temptation to sacrifice the future for the present, and I felt the responsibility of reminding the Committee of the shortsightedness of such a policy.

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August 4, 1986

The Honorable Robert Garcia
Chairman
U.S. House of Representatives
Committee on Post Office and Civil Service
Subcommittee on Census and Population
219 Cannon House Office Building
Washington, D.C. 20515

Dear Mr. Garcia:

This is in reply to the questions you raised in your July 25 letter regarding plans for evaluating the 1990 census.

Following the tradition of good statistical practice, I would like to start off with some caveats. It's about 13 years since I left the Census Bureau. During this period, attendance at professional meetings and my work on the Panel on Decennial Census Methodology of the Committee on National Statistics have kept me informed about the Bureau's activities in a general way, but it's likely that I am not aware of many of the details in the research currently carried out. As a result, some of my suggestions may be superseded by recent developments. Comments by the Bureau's professional staff on these subjects should therefore be taken into account in considering my recommended actions.

Keeping these qualifications in mind, I will attempt to answer your questions.

1. Possible improvements in methods of evaluating completeness of the count

- a) Although your question referred to improvements the Bureau's staff could make, my first suggestions refer to action outside the Bureau's scope. Demographic analysis is one of the methods used to estimate national undercoverage. Improvement in statistics on immigration and emigration would greatly enhance the accuracy of demographic analysis. The recent report on immigration and emigration data by the Committee on National Statistics indicates that there are serious deficiencies in the quality of these data, not only for illegal entrants, but also for other types of migrants. I assume that the Bureau cannot do much to improve

these data, but possibly the Subcommittee can use its influence in this regard.

Another deficiency in demographic analysis is its inability to estimate coverage of the Hispanic population. Part of the reason is that the quality problems of migration data affect the Hispanic estimates more severely than most other population groups. However, even if these problems were solved, demographic analysis would still be unable to estimate the Hispanic undercount because of the lack of birth and death statistics for all Hispanics. Data on the number of births and deaths come from birth and death registrations. The National Center for Health Statistics coordinates efforts for standardization of vital statistics records among the states. I understand that there has been considerable success in the attempt to persuade state agencies responsible for vital statistics record to include an item on Hispanic origin on the birth and death certificates. Although only 24 or 25 states include this item, they are the ones with the largest concentrations of the U.S. Hispanic population, and they account for 85 to 90 percent of births and deaths. A revised standard for the certificates is scheduled to be effective in 1989, and it is hoped that the number of states requesting this information will increase.

For purposes of coverage evaluation, it is necessary to have almost complete coverage in the vital statistics records. Perhaps the Subcommittee can assist by urging states to adopt this standard.

I should note this last point would be of future help to demographic analysis rather than of current use. It probably would require 30 or 40 years of birth and death data before the kind of demographic analysis applied to the black and the total white population could be used for Hispanics.

- b) In regard to sample survey methods of coverage evaluation, the main technique relied on by the Bureau in 1980, my suggestions refer to emphasis applied to certain components rather than to different ways of operating.

A very high response rate in the evaluation studies is essential to their success. It is important that the Bureau's field organization which is responsible for the actual data collection understands this and is

responsive to the research staff's insistence on the follow-up necessary to achieve high rates.

Accurate matching of survey and census data is also necessary. I understand the Bureau has had considerable success in developing automated matching. However, the ability to determine whether unmatched census cases should actually have been included in the post enumeration sample survey is partly dependent on the clarity and uniqueness of the areas used to select the sample. The 1980 Census used the CPS sample. Although CPS is very efficient for the purposes it was designed to satisfy, the fact that its sample does not use easily identifiable geographic boundaries keeps it from being an ideal instrument for census coverage evaluation. The Bureau has been exploring the use of city blocks and equivalent areas for sample selection. I think continuing research on this approach should be pursued vigorously. The Bureau should also examine related techniques, such as using complete buildings as sample segments.

- c) Methods of combining the best features of demographic analysis with post enumeration surveys should be examined. Some of this is currently being done at the Bureau, but I suspect that more emphasis would be useful. For example, the problems of the accuracy of demographic analysis (at the national level) are mostly due to the quality of immigration and emigration data. These do not have much effect on the black population. I suggest exploring the possibility of using demographic analysis for the black population and survey methods for others.

2. Budget for Evaluation

I hope the wording of the second question does not imply that the Bureau's research program for the 1990 census would be restricted to evaluating the population count. As I tried to make clear in my prepared statement for the Subcommittee's hearing, there are important past uses and future needs for research on other aspects of the census.

I assume the "ballpark figure" you asked for refers to a budget figure. I cannot give any specific dollar amount since I have not kept up with current salary levels, overhead rates, data processing costs, etc. My reply, therefore, relates the 1990 budget for research to the 1980 amounts. Also, the caveats I mentioned at the beginning of the letter are particularly relevant to this part of my response.

I think it would be reasonable to start off with the assumption of a 1990 budget for research at the same level as 1980 updated for inflation, and see whether the current condition call for an increase or decrease in that amount. An early step should be to estimate costs separately for studies of the completeness of the count and for other research projects since only the former are involved in adjustments. For noncoverage research, the 1980 level is probably appropriate, unless the Bureau indicates pressing needs for specific areas of research that did not exist for 1980.

The scope of the coverage studies should depend on whether or not the data will be used for adjustment. If the data are to be used for adjustment, the sample size needs to be large enough to provide considerable geographic detail, possibly state data. More limited geographic detail, and thus a smaller size, is sufficient if adjustment is not planned. Approximate sample sizes for the coverage evaluation can then be compared to the 1980 program in preparing the budget estimates. One point should be noted. The 1980 coverage estimates used CPS rather than an independently selected sample. As I indicated in response question 1, I think the Bureau should seriously consider using blocks or other geographic areas as the sample base rather than relying on CPS. I assume this will tend to increase the costs over 1980.

If a decision on whether to adjust is not reached until 1990 then there is uncertainty on whether detailed geographic data for adjustment will be necessary. The plan outlined at the Subcommittee hearing by Dr. Bailar indicates the final decision will be delayed until an examination of evaluation data is made in 1990. The sample size, scope of the program, and budget have to be fixed long before then. Some compromise will have to be made on the sample size and budget.

3. Congressional Support

Probably the most useful kind of support Congress can give to the Census Bureau is for your Subcommittee to continue the kind of hearings it has been holding, which provide a forum for interested parties to express their views on census plans. The Census Bureau has, of course, advisory committees as well as more informal ways of ascertaining the views of users of census data and other concerned social scientists. However, the importance of Congressional hearings obviously make participants consider their positions much more carefully than attendance at other kinds of meetings.

Other areas of support I can think of that would be helpful to the Bureau are only partly within the scope of the

Subcommittee's jurisdiction, but the Subcommittee may influence decisions by making its views known. One area is the budget. I think it's important that there are funds available for research and development.

Secondly, the requirement for early release of the population counts may be a major stumbling blocks in the ability to adjust the data. Delaying the release dates by one or two months might substantially improve the feasibility of adjustment. I realize that the early release is tied to redistricting plans and any delay may have serious implications. Perhaps the Subcommittee could look into the possibility of some relief from the tight deadline.

A third issue of a somewhat different character relates to the proliferation of suits to revise the census figures after the 1980 census. Preparing testimony occupied an inordinate amount of time for some of the most talented and productive staff members and seriously detracted from attention to important planning activities. Anything that could be done to reduce such drains on the staff would be quite helpful.

I hope these responses are useful to your Subcommittee's work. If I can help in any other way, please let me know.

Sincerely,



Joseph Waksberg
Vice President

JW/eg

Mr. GARCIA. Mr. Carlucci, you have just heard the Census Bureau testify that they do the best job that can be done in actually counting people, but it is still not enough. In fact, the National Academy panel says that anything more they do in this field might make things worse. Yet, you seem to be saying that they should do better and that deciding to adjust might make it hard for them to actually get people's help.

What do you think the Census Bureau should do about the undercount of poor people and minorities?

Mr. CARLUCCI. Well, I can't say I have a clear answer, and I don't think that anybody believes that the methodology that the Bureau is developing—and I am glad to hear that other people think that that methodology will be so effective. I don't think anybody is suggesting that there is a better way to adjust. I am suggesting that there are still problems. An adjustment may improve the count of those groups that have had the severest undercount, but the methodology still will produce a differential adjustment, that certain groups will receive less of an adjustment than others.

Part of the reason is that those groups and the areas they live in are more difficult to count, and to some extent it is the responsibility of those areas to participate and to support the Bureau in doing that. I realize how difficult it is to get local support, and I guess what I am saying is that the promise of an adjustment will extinguish whatever effort exists for local support.

I don't know, and I am not saying that is enough of a reason to not adjust. I am not saying that, as a matter of fact. I am saying that is something you have to take into account in the timing. NAS has said that the decision should be made early, and it is concerned about the Bureau's intent to make the decision at a later date. That timing is certainly going to have an impact on how people participate and how that adjustment is seen.

Mr. GARCIA. Thank you, Mr. Carlucci.

This question is addressed to both Professor Stoto and Professor Ericksen. In your statements, you both mention and you urge that the Congress itself play more of a role and be more involved in the question of the adjustment. Now I will say to both of you, having spent 20 years of my life in an elected office and having lived through five reapportionments, that I think you are wrong in the sense that I just don't think that we are the proper judges of adjustments because it seems to me that we would slant everything in our favor. I mean I just think that would be the trend. Nobody apportion himself out of a district. I would appreciate it if you would be kind enough to comment.

Mr. STOTO. That certainly is a very difficult question. I think that it is important to stress the fact that the input, the policy and political input should come before 1990, before the figures are in. I think it is only human nature that once the figures are in people, Congressmen would find it very difficult to think objectively about criteria.

On the other hand, perhaps I can give an example of something I believe would be helpful before 1990. As I mentioned in my statement, there were various different aspects of accuracy and there is no simple agreement on them. For instance, would it be an improvement, if suppose that we knew with certainty that the census

was perfectly accurate in 49 States, but had an undercount of 10 percent in one State, and we could change that situation and make it to one in which there was a 50-50 chance that every State would be either 2 percent up or 2 percent down? That kind of an adjustment is one that substitutes random error for systematic error.

It may be helpful for the statisticians to propose hypothetical situations like that to Congressmen and say, would you be willing to adjust—do you regard that as an improvement? And as long as the State of Massachusetts is not that one, perhaps people could make judgments about what constitutes improvement.

Mr. GARCIA. You are aware of how congressional seats are apportioned, are you not?

Mr. STOTO. Yes, I am.

Mr. GARCIA. In terms of orders of priority based on population, and, Mr. Carlucci, maybe you can correct me if I am wrong, I think New York received a 34th Member of Congress on a 432 or 433 order of priority. I think we may have won but I think Indiana was one of the States that lost a seat. It seems to me based on what we are talking about now an adjustment in that one State, as it relates to the priority as we select after the first go-round may lead to further questioning and lawsuits. In 1980, long after the census was completed and the States were reapportioned, I met with a delegation from the State of Indiana. I met with the Governor, the U.S. Senators, and the full congressional delegation—because they lost a seat. Yet they thought that they should have kept the seat, and I think they argued for an adjustment. And rightfully so. I mean I can't blame them.

But the point is that, as chairman of the subcommittee during the last census and now as chairman prior to the forthcoming census, I would like to state to both you gentlemen that I think the most that Congress can do is exactly what we are doing now. That is, monitoring the census and making sure that we have these hearings on an ongoing basis to let them know this committee is holding up to its responsibility as it relates to making sure we know what they are doing.

But I would not advocate that we play a role outside of this committee, or maybe the Appropriations Committee which handles Commerce and the Bureau of the Census. So I say that to you because it just seems to me that I would not like politicians to get involved in the process. I just think we should stay out of it, except to do that we are doing.

Mr. STOTO. I agree with you. If I can make this short statement, I believe that it is important for this subcommittee to take up these matters, and I think this is the appropriate forum.

Mr. GARCIA. Yes, right.

Dr. Ericksen, if you can, for a minute, I guess, respond to that. And, Mr. Waksberg, if there is anything you would like to add for another minute, and then I am going to have to run to vote. And I don't think I am going to come back, so we will close the hearing. I have some questions, though, that I would like to submit to you, and I would appreciate very much if you can get your responses back to staff so that we can complete the record on this hearing.

Dr. Ericksen.

Dr. ERICKSEN. I want to state very clearly that in my comments I had no intention that the Congress should have anything to do with the decision about adjustment after the data are in. You can be sure that if Florida had the 436th seat and Indiana had the 435th the lawsuit would have gone the other way around.

Mr. GARCIA. That is right.

Dr. ERICKSEN. What I meant was, the Congress has a choice, and that choice will be made sometime in the near future, and this is where Congress plays a very important role. In allocating the budget for the 1990 census, if the Congress goes the route of saying we want you to have coverage improvement programs and we are going to allocate another \$342 million or more, then, in not allocating money for the development of an adjustment methodology, that is how the decision not to adjust will essentially be made, in my opinion.

On the other hand, if you say to the Census Bureau, we want you to emphasize the development of an adjustment methodology, we know from the 1980 census, a lot of the coverage improvement programs didn't work, then you will be furthering the cause of an adjusted and a more accurate census.

Mr. GARCIA. Thank you. Mr. Waksberg, is there anything you would like to add for another 30 seconds?

Mr. WAKSBERG. Well, I want to make just one comment about the concern about different levels of undercount and how to change them. Looking at adjustment by itself as if it were the only issue that gets involved is probably looking at a very small part of the issue. The Bureau, in its planning, makes decisions which affects it for example, in the \$300-odd million spent for coverage improvement programs. If you look at where that goes, it is obviously to improve coverage where coverage needs improvements—in the inner cities of the big cities, some of the types of rural areas, and so on. These decisions made by the Bureau themselves are intended to reduce the level of differential undercount. And I am not sure I see why thinking of adjustment changes the perception of what the Bureau should be doing there.

Mr. GARCIA. I would like to thank all of you very much. I would hope that you would stay in touch with this subcommittee because obviously there is a great deal that has to be done, and this subcommittee is really concerned about 1990. We are working on it, as you can see. We are starting early, and we are not going to stop. We have been at the process now for about a year and we will continue.

[Whereupon, at 12 noon, the subcommittee was adjourned, to reconvene subject to the call of the Chair.]

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