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An Exploratory Analysis of Response Rates in the 1990–91 Schools and Staffing Survey (SASS)

Fritz Scheuren, George Washington University
David Monaco, Fan Zhang, Gloria Ikosi, Michael Chang,
Synectics for Management Decisions, Inc.

Kerry Gruber, National Center for Education Statistics

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Schools and Staffing Survey

An Exploratory Analysis Of Response Rates

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Contact:
Project Officer
Kerry Gruber
(202) 219-1461
FAX: (202) 219-1575

Foreword

This technical report is one in a continuing series of methodological studies pertaining to the Schools and Staffing Survey (SASS). An earlier report, the *Quality Profile for SASS: Aspects of the Quality of Data in the Schools and Staffing Surveys (SASS)* (Jabine, 1994) documented survey procedures and summarized information on a variety of survey errors, for the 1987-88 and 1990-91 SASS data collections. In the *Quality Profile*, nonresponse was of interest as an indicator of survey data quality. In this report, nonresponse is examined for the purpose of understanding the potential biases there are in response, with an eye towards altering survey operations in the future and perhaps understanding more about the types of schools, principals, teachers, or school districts that are less likely to participate in SASS.

The word "exploratory" as used in the title refers to the multivariate analysis of nonresponse and is a new procedure for SASS. Nonresponse analysis has often been limited to qualitative techniques, in part due to the small number of nonrespondents and to a sparse set of explanatory variables. The use of more sophisticated techniques is a welcome development, especially when other background (sampling) variables become available to the analyst. More work is needed to perfect such modeling techniques.

This report also joins another methodological report, *Design Effects and Generalized Variance Functions for the 1990-91 Schools and Staffing Survey (SASS)* (Salvucci, Weng, and Kaufman, 1995) in "pushing the envelope" of analytic techniques outward. Other methodological research on SASS, including nonresponse, has been developed by statisticians at the Bureau of the Census and NCES, as well as under contract with Synectics for Management Decisions and Westat:

- reinterview techniques testing the quality of item response (Bushery, Royce, and Kasprzyk, 1992);
- an examination of the accuracy of teacher's self-reports of the number of credit hours or the number of courses taken as an undergraduate or graduate student (Chaney, 1994);
- an analysis of the differences in survey estimates across the various components of SASS (Fink, 1994);
- developing a method to compare QED (original frame) and CCD (current frame) estimates (Holt and Scanlon, 1994);
- cognitive research on questionnaire design, with the goal of increasing response rates by making the survey form more "user-friendly" (Jenkins, 1992);
- cognitive research on the Teacher Listing Form, leading to major form redesign (Jenkins and Von Thurn, 1996);
- a summary of several research studies on the quality of SASS data (Kasprzyk, et. al., 1994);
- Investigation into bootstrap variance methodology has resulted in its use for the 1993-94 SASS (Kaufman, 1993, 1995); the bootstrap variance technique compensated for difficulties observed in using the balanced half-sample replication variance estimator (Kaufman 1992).
- Steve Kaufman of NCES has also been developing a bootstrap variance estimator for implementation in the 1993-94 SASS (Kaufman, 1993, 1995) compensating for difficulties observed in using the balanced half-sample replication variance estimator (Kaufman, 1992).

- a generalized least squares method for adjusting several SASS estimates to PSS simultaneously (Li and Scheuren, 1996);
- examination of the need for integration of sampling frames (McMillan, Kasprzyk, and Planchon, 1993);
- an examination of the effect of the mode of interview (mail or telephone) (Parmer, Shen, and Tan, 1992);
- results of a survey design experiment on the Teacher Listing Form (Royce, 1994);
- the development of logistic regression methods in sample weighting adjustment to compensate for observed nonresponse bias (Shen and Fisher, 1993);
- a Bayesian analysis of SASS nonresponse (Shen, Parmer, and Tan, 1992);

Working Papers not yet issued include:

- research on the topic of periodicity for SASS (Smith, Ghosh, and Chang, 1995);
- a generalized least squares method for adjusting several SASS estimates to PSS simultaneously in the 1993-94 SASS (Scheuren and Chang, 1996);
- a method for estimating item response variance (Kaufman, 1996).

Paul Planchon
Associate Commissioner
Surveys & Cooperative Systems Group

Daniel Kasprzyk
Program Director
Education Surveys

SASS Methodological Papers and Reports Reference List

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Chapter 1 Study Overview and General Background*

1.1 Purpose of Study

This report has four main goals: (1) summarizing known technical and evaluative information about response rates in the 1990-91 round of the Schools and Staffing Survey (SASS); (2) exploring what more can be learned about differences between respondents and nonrespondents by intensively studying the 1990-91 SASS data; (3) identifying gaps in that knowledge; and (4) suggesting priorities for future SASS research.

The current undertaking is in line with recommendations by the Subcommittee on Survey Nonresponse of the Federal Committee on Statistical Methodology[1] which called for more analysis of nonresponse and its adjustment -- leading to potential improvements in the effectiveness of survey data collection operations. It is also part of a comprehensive effort by the National Center for Education Statistics (NCES) to systematically review the quality of the Schools and Staffing Survey (SASS). A number of reports have already been issued as part of the SASS quality review, notably the 1994 quality profile done by Jabine[2].

The Schools and Staffing Survey (SASS) is a periodic, integrated system of sample surveys on elementary and secondary schools in the United States[3]. SASS collects information from several types of respondents -- such as school district personnel, public school principals, private school heads, plus public, and private school teachers.

Consistent with its goals, the current report was constructed by reexamining the existing SASS documentation for the 1990-91 effort and on an observational and statistical examination of nonresponse based on the data of the 1990-91 survey[4]. Part of that background material is included in this Chapter. Most of the sample design and procedural details are to be found in Chapter 2.

Extensive additional analyses were also conducted for this volume to see what else could be learned about SASS response rates. Chapter 3 provides, in great depth, the main descriptive

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* Robert Parke was a principal contributor to this Chapter.

[1] Subcommittee on Survey Nonresponse of the Federal Committee on Statistical Methodology (1994), as discussed in Gonzalez, M., Kasprzyk, D. and Scheuren, F. (1994). "Nonresponse in Federal Government Surveys." AMSTAT NEWS, April 1994. This summary also appears in a more extended way in Shettle, C., Guenther, P., Kasprzyk, D., and Gonzalez, M. (1994). "Investigating Nonresponse in Federal Surveys." Proceedings of the Section on Survey Research Methods, American Statistical Association. Alexandria VA: American Statistical Association.

[2] Jabine, T. (1994). Quality Profile for SASS, Aspects of the Quality of Data in the Schools and Staffing Surveys (SASS). Technical Report, NCES 94-340. U.S. Department of Education, Office of Educational Research and Improvement, Washington, DC: National Center for Education Statistics.

[3] The main survey operations for SASS, including sample selection, data collection and data processing are carried out by the U.S. Bureau of the Census under an interagency agreement with NCES.

[4] This documentation was supplied by the U.S. Bureau of the Census, primarily in the form of internal memoranda, and on an observational and statistical examination of nonresponse based on the data of the 1990-91 survey.

results from these explorations. In Chapter 4, the inferential modeling of the response rates is summarized. Chapters 3 and 4 build on what is known about SASS operations (from Chapter 2) -- leading to Chapter 5, which consists of some overall conclusions and recommendations. To complete the report, there is also an extensive list of references and related bibliographic citations, plus two appendices. Appendix A provides the mathematical and statistical details supporting Chapter 4. Appendix B contains extensive descriptive tabular material that will allow readers to explore the issues raised in Chapter 3 in greater detail.

In the remaining part of this Chapter, some reasons for analyzing nonresponse will be given and illustrated within a SASS context (Section 1.2). The Chapter concludes with basic definitions to complete the background (in Section 1.3).

1.2 Reasons for Analyzing Unit Response Rates

Nonresponse in surveys can arise when one or more items are missing from a questionnaire or when the entire questionnaire is unobtainable or unusable. The focus here will be on the latter, unit nonresponse.

In general nonresponse reduces the size of the sample, increases its variance and can result in biased estimates. Nonresponse studies are motivated by a need to measure the success of the sampling scheme, explain nonresponse where possible, control and adjust survey estimates for bias, and improve survey operations. In the remainder of this Section, each of these objectives are discussed in terms of what is known about SASS.

Improving survey operations-- Preventing or reducing nonresponse to a bare minimum has to be a goal of any survey. Obviously, finding ways to do this in a cost effective manner is the key. Specifically, for SASS, where are the weak points in survey operations and how can each of the component surveys be improved?

How much of the SASS nonresponse is due to sensitivities in content or wording in survey questionnaires? What about the length of time it takes to complete a SASS questionnaire? How much nonresponse is due to logistical drawbacks (e.g., non-updated mailing list, less-than-prompt distribution of mailing pieces, etc.)?

Reasons for nonresponse may be developed from survey control information on attempts to contact (such as repeat mailings), refusals, and final response status. Follow-up questions asked of a sample of survey nonrespondents could also be used to obtain information on why nonresponse occurred. Chapter 2 of this report summarizes what is known about SASS operations and their effect on response rates.

Adjusting survey estimates. --What information on nonresponse can be used to adjust survey estimates? How much of this "repair work" can be based reliably on the population already sampled? How effective are follow-up surveys[5] in preparing estimates for nonrespondents?

The use of nonresponse weighting adjustments is common in sample surveys.[6] These typically reweight survey results using information from respondents rather than just from the nonrespondents reached on follow-up. This form of nonresponse adjustment makes use of stratification variables as well as other information known in advance to reweight response; it has as its goal producing a distribution which approximates that of the original sample. SASS adjustment procedures for 1990-91 were of this type. (See Chapter 2)

Follow-up studies might make use of new responses to elicit patterns not evident in the original survey. For example, if schools that respond to a second request for information offer a vocational/technical program in a significantly different proportion than schools that respond to the first mailing, this may provide a basis for estimating the prevalence of a type of educational program among nonrespondent schools.[7]

Measuring success in reaching survey subjects -- How successful is the survey in reaching the various populations it is intended to cover? Users may want to know how much nonresponse there is and how it is distributed among the various groups surveyed. Response rates calculated for various subpopulations in the sample convey this information. For example, one might ask if the SASS School Survey is as successful in securing responses from private schools as from public schools. Questions of this sort are the main focus of the current report, especially in Chapter 3.

Explaining nonresponse -- How do nonrespondents differ from respondents? Of the host of traits which set them apart, which are those that are primarily responsible for nonresponse? For example, if size of enrollment and type of community are shown to be importantly related to nonresponse, how important is each of the variables or their combined effect in explaining nonresponse? The multivariate analysis done in Chapter 4 explores these relationships for SASS.

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[5] The classic paper is by Hansen, M. and Hurwitz, W. (1946). "The Problem of Nonresponse in Sample Surveys." Journal of the American Statistical Association, 46: 516-529. An accessible excerpt and summary by Scheuren appears in the AMSTAT NEWS (March 1996) in the column 50 Years ago in JASA. For more on recent work, see Särndal, C.-E., Swensson, B., and Wretman, J. (1992). Model Assisted Survey Sampling. New York: Springer-Verlag.

[6] See, for example, Oh, H. and Scheuren, F. (1983). "Weighting Adjustments for Unit Nonresponse." In Incomplete Data in Sample Surveys, Volume 2: Theory and Bibliographies. Madow, W., Olkin, I., and Rubin, D. eds., 143-184. New York: Academic Press. See also Kalton, G. (1983). Compensating for Missing Survey Data. Ann Arbor: Institute for Survey Research, University of Michigan. Kalton, G. and Kasprzyk, D. (1986). "The Treatment of Missing Survey Data." Survey Methodology, 12: 1-16.

[7] For more on these methods, another classic source is the paper by Politz, A. and Simmons, W. (1949). "An Attempt to Get "Not-at-homes" into the Sample Without Call-backs." Journal of the American Statistical Association, Volume 49. For a summary, see, for example, Cochran, W. (1977). Sampling Techniques. New York: John Wiley and Sons, Inc.

Researching opportunities for bias--Do nonrespondents differ from respondents in ways that affect important survey outcomes? For example, if survey data on teacher shortages were regionally biased, estimates made from these data, without adjusting for that differential, would be biased too. Such biased results could not be generalized to the whole population; and, hence, could not serve as the basis for recommendations on national policy addressing the problem. More exploration of these issues in SASS is definitely needed and is among the areas for future study called for in Chapter 5.

Concerns about bias are generally greater as the rate of nonresponse increases[8]. While it is difficult to obtain objective measures of the bias, it is more often possible to appraise the potential for bias. This can be achieved by analyzing the differences in the characteristics of respondents and nonrespondents -- the main approach taken here for SASS.

1.3 Definition of Terms

Listed below are the key definitions necessary to read this report. These have been drawn from existing NCES publications and most should be unneeded by those already familiar with the Schools and Staffing Survey (SASS).

The terms appearing here include public and private school, teacher, administrator, and local education agency (LEA); classifiers such as census region, association (for private schools), urbanicity, school level, and school size are also covered. Finally, a working definition of weighted and unweighted response rates is included; but much more detail on alternative response rate definitions is given in Appendix B where several alternatives are employed in a series of detailed tables.

The sampling frame used to carry out SASS differs depending on whether the school is private or public. The public sector surveys[9] are based on an administrative census conducted annually by NCES, called the Common Core of Data (or CCD)[10]. For private sector[11] schools, the frame is based on the Private School Survey (or PSS)[12] which is a census conducted every two years by NCES.

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[8] Actually, both the variance and bias components of the mean square error generally increase as the rate of nonresponse increases. Bias and variance tradeoffs exist, of course, depending on how successful the adjustments are for the differentials identified in response patterns. An excellent recent overall treatment is Lessler, J. and Kalsbeek, W. (1992). Nonsampling errors in surveys New York: John Wiley and Sons, Inc.

[9] These are the teacher demand and shortage survey (TDS), the public school survey, the public school administrator survey, and the public school teacher survey. Each of these data collection efforts is discussed in detail in Chapter 2.

[10] For a detailed discussion of the use of the Common Core of Data in SASS, see Zhang, F., Saba, M., and Scanlon, B., CCD Adjustments to the 1990-91 SASS: a Comparison of Estimates NCES Working Paper, 95-08. U.S. Department of Education, Office of Educational Research and Improvement, Washington, DC: National Center for Education Statistics.

[11] These are the SASS private school survey, the private school administrator survey, and the private school teacher survey. For details, see Chapter 2.

[12] For information on the 1989-90 PSS, see Kaufman, S. and Huang, H. (1993). op. cit.

For the 1990-91 SASS, the public sector surveys were based on the 1988-89 CCD and for the private sector surveys, the 1989-90 PSS. Details of the SASS sample design and selection, component by component, are given in Chapter 2.

Public School -- SASS defines a public school as an institution that provides educational services for at least one of grades 1-12 (or comparable ungraded), has one or more teachers to give instruction, is located in one or more buildings, receives public funds as primary support, has an assigned administrator, and is operated by an education agency.

The CCD defines a public school as an institution which provides educational services and has one or more grade groups (PK-12) or which is ungraded, has one or more teachers to give instruction, is located in one or more buildings, has an assigned administrator, receives public funds as primary support, and is operated by an education agency.

The SASS definition is similar to CCD, except that SASS considered a public school out-of-scope if it did not have any students in any grades one to 12. Schools offering only kindergarten and prekindergarten were deleted from the sampling frame before the sample was selected. Schools without a permanent administrator were considered out-of-scope for the administrator components. A school was also considered out-of-scope for SASS if it was closed or merged with another out-of-scope school.

Private School.-- SASS defines a private school as a school not in the public system that provides instruction for any grades one to 12, or equivalent ungraded, and where the instruction was not given exclusively in a private home. To be included in SASS, a school was required to provide instruction to students in at least one of grades one to 12 (or equivalent ungraded) and not to be in a private home. (if it could not be determined whether or not it operated in a private home, the school had to have at least ten students or more than one teacher.) Schools that taught only prekindergarten, kindergarten, or adult education were not included.[13]

PSS defines a private school as an institution which provides educational services for any of grades one to 12 (or equivalent ungraded), have one or more teachers to give instruction, are not administered by a public agency, and are not operated in a private home.

SASS considered a private school out-of-scope if it did not have any students in any grades one to 12 (or equivalent ungraded). Schools offering only kindergarten and prekindergarten were deleted from the sampling frame before the sample was selected. Schools without administrators were considered out-of-scope. A school was also considered out-of-scope if it was closed or merged with another out-of-scope school.

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[13] SASS assigned private schools to one of three major (affiliation) categories, and within each major category, one of three subcategories -- making nine typologies altogether. The categories and subcategories are: 1) Catholic--parochial, diocesan, and private order; 2) other religious -- conservative Christian, nationally affiliated, and unaffiliated; and 3) nonsectarian--regular, special program emphasis, and special education. See McLaughlin, D., O'Donnell, C., Ries, L., and Broughman, S. (1995). Private Schools in the United States: A Statistical Profile, 1991. Statistical Analysis Report, NCES 95-330. U.S. Department of Education, Office of Educational Research and Improvement, Washington, DC: National Center for Education Statistics.

Teachers. -- For this report SASS defines a teacher as any full-or part-time teacher whose primary assignment was to teach in any of grades 1-12. Part-time teachers were those who reported working less than full time as a teacher at their school. Itinerant teachers and long term substitutes who were filling the role of a regular teacher on an indefinite basis were also included. An itinerant teacher was defined as a teacher who taught at more than one school.

CCD (PSS for private schools) defines a teacher as a professional school staff member who instructs students and maintains daily student attendance. The CCD/PSS definition of a teacher does not exclude specific categories of instructors. SASS excluded specific types of instructors that may have fit within the CCD/PSS definition of a teacher.

SASS considered a sample teacher out-of-scope if he/she is a short-term substitute, a student teacher, a nonteaching specialist (e.g., guidance counselor, librarian, nurse, psychologist), an administrator (e.g., principal, assistant principal), a teacher's aide, or in some other professional or support staff position (cook, custodian, bus driver, dietitian, secretary). If a sample school is out-of-scope, all teachers from that school are also considered out-of scope.

School Administrator. --SASS defines an administrator as the person who is primarily responsible for overseeing the administrative operations of a school.

CCD (PSS for private schools) defines an administrator as a staff member whose activities are concerned with directing and managing the operation of a particular school: principals, assistant principals, and other assistants, those who supervise school operations, assign duties to staff members, supervise and maintain the records of a school's instructional activities with those of the education agency, and department chairpersons.

Although SASS does not list the specific type or categories of individuals who are school administrators, the main emphasis of the definition for SASS and CCD/PSS is the same. SASS and CCD/PSS define a school administrator as the person or staff member who is primarily responsible for overseeing the administrative operations of a school.

SASS considers a school administrator out-of-scope if the school did not have a permanent administrator. Also, if a sample administrator's school is considered out-of-scope, the administrator is automatically classified as out-of-scope.

Local Educational Agency (or LEA). --For both SASS and CCD a public school district was defined as a government agency administratively responsible for providing public elementary and/or secondary instruction and educational support services.

For CCD the agency or administrative unit was required to operate under a public board of education. Districts that did not operate schools but that hired teachers were included. A district was considered out of scope if it did not employ elementary or secondary teachers of any kind, including special education and itinerant teachers.

Again, for SASS, a local education agency or LEA was required to operate under a public board of education. As with SASS, districts that did not operate schools but that hired teachers were included.

Census Region.-- The United States is divided here according to four regions established by the U.S. Bureau of the Census. The regions are:

> Northeast. -- Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania.
>
> Midwest. -- Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.
>
> South. -- Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, Texas.
>
> West. -- Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, Hawaii.

Association: Private schools were selected using a dual frame approach. A list frame was compiled from the membership lists of 17 major private school association groups plus an "All Else" category. To compensate for the schools that are not members of the major private school associations an area frame was designed to represent undercovered schools. These 18 stratification categories are:

1. Association of Military Colleges and Schools,
2. National Catholic Education Association, Jesuit Secondary Education Association,
3. Friends Council on Education,
4. National Association of Episcopal Schools,
5. Hebrew Day Schools,
6. Solomon Schechter Day Schools,
7. Other Jewish,
8. Lutheran Church - Missouri Synod,
9. Evangelical Lutheran Church - Wisconsin Synod,
10. Evangelical Lutheran Church in America,
11. Other Lutheran,
12. General Council of Seventh-Day Adventists,
13. Christian Schools International,
14. American Association of Christian Schools,
15. National Association of Private Schools for Exceptional Children,
16. American Montessori Society Schools,
17. National Association of Independent Schools, and
18. All Else.

Urbanicity. -- Except for the Teacher Demand and Shortage Survey,[14] Urbanicity was derived from a seven-category locale code developed by Johnson[15] and used for the CCD/PSS. The locale code was based on the school's mailing address matched to U.S. Bureau of the Census data files containing population density data, standard metropolitan statistical area codes, and a Census Bureau assigned code defining urban and rural areas.[16] The following seven categories are used:

1. Large Central City: central city of a Metropolitan Statistical Area (MSA) with a population greater than or equal to 400,000 or a population greater than or equal to 6,000 people per square mile.

2. Mid-size Central City: central city of an MSA with a population less than 400,000 and a population density of less than 6,000 people per square mile.

3. Urban Fringe of Large Central City: place within an MSA of a Large Central City and defined as urban by the U.S. Bureau of the Census.

4. Urban Fringe of Mid-size Central City: place with in an MSA of a Mid-size Central City and defined as urban by the U.S. Bureau of the Census.

5. Large Town: town not within an MSA, with a population greater than or equal to 25,000 people.

6. Small Town: town not within an MSA, with a population less than 25,000 and greater than or equal to 2,500 people.

7. Rural: a place with less than 2,500 people and coded as rural by the U.S. Bureau of the Census.

For the present report, these seven locale codes were aggregated into three urbanicity types:

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[14] For the Teacher Demand and Shortage survey, urbanicity was defined in terms of Metropolitan Statistical Areas (MSAs). An MSA is an area, as defined by the Office of Management and Budget (OMB), with at least 50,000 people or with more than one city with a population totaling at least 50,000. Three urbanicity categories were used: (1) Central City of MSA, (2) Not a Central City of an MSA, and (3) Not an MSA.

[15] Johnson, F. (1993). "Comparison of School Locale Settings: Self vs. Assigned." Proceedings of the Section on Survey Research Methods, American Statistical Association. Alexandria, VA: American Statistical Association. Also in NCES Working Paper Series, No. 94-01.

[16] This code is believed to provide a more accurate description of the community than the respondent's reported community type used in earlier analyses of the 1987-88 SASS. These community types aggregated from Johnson's locale coding were in a few cases changed by the state education agency. NCES and the state education agencies have a cooperative agreement allowing states to review and, where appropriate, modify data previously submitted to NCES. The 1988-89 CCD universe file used for the SASS sample selection included 423 schools with changes to the NCES assigned locale code. Eighty-two of those schools were selected into SASS, and in 47 of those schools, the change affected this school's assignment to the three community types used in this report. See Jabine, T. (1994). op. cit.

Central City: urbanicity locale codes Large Central City and Mid-size Central City

Urban Fringe/Large Town: urbanicity locale codes Urban Fringe of Large Central City, Urban Fringe of Mid-size Central City, and Large Town

Rural/small town: urbanicity locale codes Small Town and Rural

School Level -- The SASS definition of school level was used to categorize CCD data (PSS for private schools). For this analysis the SASS variable has been divided into three categories: Elementary, Secondary, and Combined:

Elementary. -- A school is defined as elementary if it has no grade higher than eighth and at least one of grades 1-6.

Secondary. -- A school is defined as secondary if it has no grade less than seventh and at least one of grades 7-12.

Combined. -- A school is defined as combined if it has at least one grade of sixth or below and at least one grade of ninth or above. Schools in which all students are ungraded (i.e., not classified by standard grade levels) are also classified as combined.

School Size. -- The SASS definition of school size[17] was used to categorize CCD data (PSS for private schools). Routinely, SASS divides this variable into four categories: 1 to 149, 150 to 499, 500 to 749, and 750 or more.[18] These size class conventions have been followed in all the basic tables in this report. For SASS, the size categories were based on the number of students (in headcounts) who were enrolled in grades one through 12 in the school on or about October 1, 1990 (as reported in Item 1 on the School Questionnaire).

Unweighted Response Rates. --The unweighted response rates were derived by dividing the number of sampled respondents by the total number of eligible sampled cases (the number of sample cases minus out-of-scope cases).

[17] Except for the Teacher Demand and Shortage survey, where for this report size is defined by the number of public schools run by the LEA or local education agency. For LEAs there were two categories: '0 to 5 Schools' and '5 or More Schools'.

[18] For the teacher demand and shortage survey, the LEAs were classified by the number of students into eight categories: '0 to 299', '300 to 599', '600 to 999', '1000 to 2499', 2500 to 4999', '5000 to 9999', '10000 to 24999', '25000 or More'.

Weighted Response Rates -- The weighted response rates were derived by dividing the sum of the basic weights for all responding cases by the sum of the basic weights for all the eligible cases.[19] The basic weight is assigned to all sampled cases and is the inverse of the probability of selection.

[19] In Appendix B there are more details on possible alternative definitions and what impact their use might have; however, for the main report, this simple definition should suffice.

Chapter 2 Design and Operation of the 1990-91 Round of SASS

2.1 Introduction

The present Chapter sets the stage for the descriptive and inferential analyses of unit response rates in the 1990-91 Schools and Staffing Survey (SASS); these are to be carried out in later chapters. It also has another goal -- to examine those procedures in SASS that already lead to a lessening of nonresponse or to provide enough background that might make it possible to speculate on still better ways to prevent nonresponse or handle it more efficiently when it occurs.

Organizationally, the material is laid out quite simply. This introductory section (Section 2.1) is followed by four more sections: A section outlining the structure of the SASS sample design[20] (Section 2.2); A section on SASS data collection[21] procedures, including the nonresponse reduction methods[22] currently in use during the 1990-91 round of SASS (Section 2.3); Additionally, there is a section about the calculation and use of SASS nonresponse adjustment factors (Section 2.4); The Chapter concludes with a brief summary of the main points and discusses possible procedural changes (Section 2.5).

2.2 SASS sample design

The 1990-91 SASS sample was designed to produce (1) national estimates for public and private schools; (2) state estimates for public schools; (3) state/elementary, state/secondary, and national combined estimates for public schools; and (4) detailed association estimates and grade level estimates for private schools. To achieve this end, a set of interrelated national surveys were undertaken:

1. The School Questionnaires included information on student characteristics, staffing patterns, school policies, student-teacher ratios, types of programs and services offered, length of school day and school year, graduation and college application rates, and teacher turnover rates. There were both public and private school surveys conducted. They were quite similar in the data sought, except that for private schools information was collected on aggregate demand for both new and continuing teachers.

[20] Based on S. Kaufman and H. Huang (1993). 1990-91 Schools and Staffing Survey: Sample Design and Estimation. National Center for Education Statistics, Technical Report 93-449. U.S. Department of Education, Office of Educational Research and Improvement, Washington DC: National Center for Education Statistics.

[21] As mentioned earlier, all survey operations for SASS, including sample selection, data collection and data processing are carried out by the U.S. Bureau of the Census under an interagency agreement with NCES

[22] Some of this material was taken from the quality profile report done for SASS by Jabine, T. (1994). Quality Profile for SASS, Aspects of the Quality of Data in the Schools and Staffing Surveys (SASS): Technical Report, NCES 94-340. U.S. Department of Education, Office of Educational Research and Improvement, Washington, DC: Government Printing Office.

2. The School Administrator Questionnaires collected background information from principals on their education, experience, and compensation, and their perceptions of the school environment and educational goals. Again, both a public and a private school version of this survey were conducted.

3. The Teacher Questionnaires, for public and private schools, collected information on demographic characteristics of public and private school teachers, their education, qualifications, income sources, working conditions, plans for the future, and perceptions of the school environment and the teaching profession.

4. The Teacher Demand and Shortage (TDS) Questionnaire targeted public school district personnel who provided information about their district's student enrollment, number of teachers, position vacancies, new hires, teacher salaries (and incentives), and hiring and retirement policies. While data for both public and private schools were obtained on teacher supply and demand, that for private schools was collected as part of the private school questionnaires. Only for the public schools was there a separate questionnaire.

The target populations for the 1990-91 SASS included all U.S. elementary and secondary public and private schools with students in any of grades 1-12 (or comparable ungraded levels), principals and classroom teachers in those schools, and local education agencies (LEAs) that employed elementary and/or secondary level teachers.[23] In all, there are seven separate survey instruments, defined by the sampling unit: school, school administrator, teacher, or LEA; and, for the first three of these by whether the school was public or private.[24] Three primary steps in the sample selection process were followed during the 1990-91 SASS:

1. School Sample. The School samples form the basis for all other survey samples. The sample of schools was, therefore, selected first. The identical sample was used for the School Administrator questionnaire.

2. Teacher Sample. For each school with a school questionnaire, a list of teachers was obtained for which a sample was selected for inclusion in the Teacher sample.

3. Teacher Demand and Shortage Sample. The sample for the Teacher Demand and Shortage Survey was the set of LEAs that were associated with the public school sample. In addition, since some LEAs may not contain any schools, but hire teachers who work in schools in other LEAs, a set of LEAs not associated with schools were selected as part of the sample.

[23] As already noted in the initial discussion of TDS data, in the private sector, since there is no counterpart to the LEAs; information on teacher demand and shortages was collected directly from individual schools.

[24] There were also separate questionnaires given to Bureau of Indian Affairs schools; however, this part of SASS has been excluded from the current report.

Details pertaining to the frame, stratification, sorting, and sample selection for each of the four surveys of SASS are described in the sections below and are based on Kaufman and Huang, 1993.[25]

Public School Questionnaire--. The primary frame for the public school sample was the 1988-89 Common Core of Data (CCD) file.[26] The CCD survey includes an annual census of public schools, obtained from the states, with information on school characteristics and size. A supplemental frame was obtained from the Bureau of Indian Affairs, containing a list of tribal schools and schools operated by that agency.

The public school sample was stratified with the allocation of schools sampled among the strata designed to provide estimates for several analytical domains. A specified number of schools were selected from each stratum with probability proportionate to the square root of the number of teachers as reported on the CCD file. Within each stratum, the schools in the frame were further sorted on several geographic and other characteristics. The achieved sample size of public schools was 9,687.[27]

The target population consisted of all public elementary and secondary schools in the United States that were in operation in the school year 1990-91. Included also were juvenile detention centers, schools associated with publicly operated hospitals and schools on military bases operated by the Department of Defense.[28]

In SASS, schools operated outside the local public school system by Indian tribes, the Bureau of Indian Affairs (BIA), or by Indian tribes under contract with the BIA were defined as Indian Schools and were treated as a separated category for both sample selection and analysis. Indian Schools had an exceedingly high response rate (99 out of the 101 sampled); hence, are not included in the analyses in this report. Nonetheless, for the sake of completeness, the stratification of Indian and other schools is laid out in its entirety in table 2.2.1 on the next page.

[25] Kaufman, S. and Huang, H. (1993). op. cit.
[26] For a general discussion of NCES sampling frames, see Peng, S., Gruber, K., Smith, W., and Jabine, T. (1993). "Monitoring Data Quality in Education Surveys." Proceedings of the International Conference on Establishment Surveys, 244-252. Alexandria, VA: American Statistical Association.
[27] In the total public school sample, there were 8,969 responding schools, 465 nonresponding schools, and 253 out-of-scope schools.
[28] Jabine, T. (1994). op. cit.

Table 2.2.1 -- Stratification Variables in the Selection of Public Schools, 1990-91 SASS.

Hierarchical Levels of Stratification For Public Schools
Bureau of Indian Affairs Schools -- Separate samples were selected first by state (in particular for Arizona, New Mexico, South Dakota, and then "All Other States"); and, finally, within state by the grade level of the school.
High Percentage Native American Schools -- Separate samples were selected first by state (in particular for Arizona, North Dakota, Oklahoma, plus "All Other States" -- except Alaska); then within states by grade level of school.
Delaware, Nevada, West Virginia Schools -- Separate samples were drawn for these schools: first by State; then LEA within state; and , finally, by grade level of the school.
All Other Schools. -- Separate samples were drawn by state and then simply by grade level of school within state.

SOURCE: Kaufman, S. and Huang, H. (1993), op. cit.

Private School Questionnaire--A dual frame approach was used to select the samples of private schools. The primary private school frame was a list compiled biennially by the U.S. Bureau of the Census from associations of private schools.[29] In addition, there was also an area frame to compensate for schools missing from the list frame.

The list sample was allocated to 216 strata defined by association group, school level, and census region. There were 18 association groups (e.g., Catholic, Jewish, National Association of Independent Schools), three school levels (elementary, secondary, combined), and four Census geographic regions (Northeast, Midwest, South, West). Allocation was proportional to the estimated number of teachers in each stratum. Within each stratum, schools were sorted by "Typology".[30] The specified number of schools was selected from each stratum with probability proportionate to the square root of the number of teachers as reported in the 1989-90 private school frame.

An area sample consisting of 123 selected Primary Sampling Units (PSUs) was selected[31] and within the selected PSUs an exhaustive search of telephone and other source materials was made for missed private schools. From this search a list of missed private schools was built. It was then sampled in a manner similar to that used to select schools from the original list frame.

[29] This compilation is called the Private School Survey (or PSS) and is a source of published information on private schools in its own right. Again, see Kaufman, S. and Huang, H. (1993). op. cit.

[30] Private schools are divided up for analytic purposes into nine typologies. For details, see McMillen, M. and Benson, P. (1991). Diversity in private schools, Technical Report NCES 92-082. U.S. Department of Education, Office of Educational Research and Improvement, Washington, DC: National Center of Education Statistics.

[31] The United States was divided into 2,054 primary sampling units (PSUs). Each PSU consisted of a single county, independent city or cluster of geographically contiguous areas defined so that each PSU had a minimum population of 20,000 according to population projections for 1988, when the PSUs were first formed. To avoid having too large a geographic area some PSUs had less than 20,000 in population. Kaufman, S. and Huang, H. (1993). op. cit.

The target sample size for private schools was 3,270, with 2,670 allocated to the list sample and 600 to the area sample.[32]

Table 2.2.2 -- Stratification Variables in the Selection of Private Schools, 1990-91 SASS.

Type of Frame	Hierarchical Stratification
Area Frame	Primary Sampling Units (PSUs), collections of contiguous counties were selected first, 123 in all. Missed schools were listed in each PSU; then, the schools were systematically selected by Grade Level (Elementary, Secondary, or Combined*).
List Frame	For each of the following Associations, separate frames were obtained and unduplicated before selections were made. The associations were Military schools, Catholic, Friends, Episcopal, Hebrew Day, Solomon Schechter, Other Jewish, Lutheran Church-Missouri Synod, Lutheran Church-Wisconsin Synod, Evangelical Lutheran, Other Lutheran, Seventh-Day Adventist, Christian Schools International, Association of Christian Schools International, National Association of Private Schools for Exceptional Children, Montessori, National Association of Independent Schools, and All Else. Within each of the 18 associations, the schools were then sampled by Grade Level (Elementary, Secondary, or Combined*). The final hierarchy in stratification was Census Region (Northeast, Midwest, South, and West).

* Nonregular schools (special education, vocational, technical, adult education, alternative/continuation grades) are classified as combined.

SOURCE: Kaufman, S. and Huang, H. (1993), op. cit.

Public and Private School Administrator Questionnaires- For the School Administrator Sample, the target population consisted of the administrators of all public and private schools eligible for inclusion in the School Survey. Once the sample of schools was selected, no additional sampling was needed to select the sample of school administrators. Thus, the administrator sample size was targeted to be the same as for the School Survey. Some of the schools in the school survey, however, did not have administrators, in which case the school was considered out of scope for the school administrator questionnaire. With a few exceptions, though, there was a one-to-one correspondence between the SASS samples of schools and school administrators.[33]

Public and Private Teacher Questionnaires-- The target population for the teacher sample consisted of full-time and part-time teachers whose primary assignment was teaching in kindergarten through grade 12, long-term substitutes filling the role of a regular teacher on a

[32] Of the total private school sample, there were 2,620 responding schools, 460 nonresponding schools, and 190 out-of-scope schools.

[33] In the total public school administrator sample, there were 9,054 responding administrators, 288 nonresponding administrators, and 345 out-of-scope administrators. For the private school administrator sample, there were 2,757 responding administrators, 268 nonresponding administrators, and 245 out-of-scope administrators.

long-term basis and teachers teaching regularly in more than one school (itinerant teachers). All schools selected in the School Samples were asked to provide teacher lists which were in turn used to select 56,051 public and 9,166 private teachers.[34]

The teacher survey designs for the public and private sectors were very similar (see table 2.2.3 below). Within each selected school, teachers were stratified into one of five types in hierarchical order, as (1) Asian or Pacific Islander, (2) American Indian, Aleut, or Eskimo, (3) Bilingual/ESL (English as a Second Language), (4) New (less than three years teaching experience), or (5) Experienced (three or more years of teaching experience). Within each stratum, teachers were selected systematically with equal probability.

Table 2.2.3 -- Hierarchical Stratification of Teachers, Public/Private Teacher Samples, 1990-91 SASS.

Hierarchical Stratification (order of selection) of Teachers
Asian or Pacific Islander
American Indian, Aleut, or Eskimo
Bilingual/ESL
New (less than 3 years in the teaching profession)
Experienced (more than 3 years in the teaching profession)

SOURCE: Kaufman, S. and Huang, H. (1993), op. cit.

Teacher Demand and Shortage Questionnaire -- Questions on Teacher Demand and Shortage are part of the school questionnaire for private schools. This is also true of the Indian Schools. For the remaining schools, an independent Teacher Demand and Shortage (TDS) Survey collects pertinent information directly from public school districts or LEAs -- the government agencies administratively responsible for providing public elementary and/or secondary education.

For the public school sector, the target population consisted of all U.S. public school districts. To draw the LEA sample, all LEAs associated with the selected schools in the school sample receive a TDS questionnaire. There is also an additional sample of districts not associated with the schools which received the TDS questionnaire. The overall sample size achieved was 5,213.[35]

[34] In the total public school teacher sample, there were 46,705 responding teachers, 4,372 nonresponding teachers, and 4,974 out-of-scope teachers. For the private school teachers sample, there were 6,642 responding teachers, 1,355 nonresponding teachers, and 1,169 out-of-scope teachers.

[35] As already noted earlier, for the private school sector, the target TDS population consisted of all U.S. private schools. The school questionnaire for the selected private schools included TDS questions for the school. Thus, the private TDS sample size was the same as the private school sample of 3,270. Those TDS data elements do not enter into the present report, since they do not come from a separate survey. For the public school TDS questionnaire, there were 4,884 responding LEAs, 329 nonresponding LEAs, and 211 out-of-scope LEAs. There were 14 LEAs in the TDS sample that did not have schools in the public school sample.

2.3 Data collection procedures

SASS was designed to be a mail-out/mail-back survey with telephone follow-ups. Both survey modes were administered by the U.S. Bureau of the Census. Questionnaires were distributed directly by mail. They were to be returned by mail to the data processing division of the U.S. Bureau of the Census in Jeffersonville, Indiana. The telephone follow-up procedure was decentralized, conducted by field representatives working from their home or from Census regional offices. Telephone follow-up questionnaires were sent to the Jeffersonville facility. Response to the survey was voluntary.

The 1990-91 SASS data collection procedure began with advance mailings to LEAs and school principals explaining the nature and purpose of SASS and asking principals to submit a list of teachers to use in selecting the sample for the Teacher Survey. The initial mailing of the School Survey took place in December 1990 and January 1991.

School and School Administrator Questionnaires-- In the initial mailing, the questionnaires for the School and the School Administrator samples were addressed to the school principals to be completed and returned to the U.S. Bureau of the Census in three weeks. There were no restrictions on who would complete the questionnaire for the school, but the Administrator questionnaire had to be completed by the school's administrator only.

After 4-5 weeks, if a school had not responded to either of the surveys, a second set of questionnaires were mailed out. If after 4 more weeks the school had still not responded, the U.S. Bureau of the Census attempted to complete the questionnaires by phone, trying to reach principals during normal office hours, 8:00 am to 5:00 pm.

Mail return rates (as a percent of total response) were modest for the 1990-91 SASS survey with higher response for the public than for the private sector. The overall mail return rate for the public sector was 67.3 percent and 55.7 percent for the private. Table 2.3.1 gives the range for the mail response rates for the public and private surveys by school grade, metropolitan area status, state (for the public data), and association (for the private data).

Table 2.3.1 -- School Survey Mail Returns as a Percent of Total Response.

(unweighted response rates)

	Public	Private
School Grade	66.8%-67.5%	47.7%-60.3%
Metropolitan Status	54.9%-73.7%	54.2%-63.1%
State/ Association	47.9%-81.1%	30.7%-66.7%

SOURCE: Kaufman, S. and Huang, H. (1993),op. cit.

The Schools and Staffing Survey results support the contention that, without follow-up to mail surveys, nonresponse error would be much greater and the validity and reliability of the data considerably reduced.[36] However, because of the substantial amount of telephone follow-up, there is concern about possible response bias due to differences in the mode of survey collection.

Shen, Parmer and Tan (1992) report no large bias due to mode of interview, but their results are not based on a controlled experiment.[37] There is some evidence of mode effects in

Table 2.3.2 -- Private School survey Mail Returns as a Percentage of Total Response.

(School Survey, List Frame only, unweighted response rates, in percent)

Association	Mail Response Rate
Assoc. of Military Colleges and Schools - US	66.7
Catholic	63.0
Episcopal	50.5
Friends	42.3
National Society for Hebrew Day Schools	35.1
Solomon Schechter	42.5
Other Jewish	36.1
Lutheran-Missouri Synod	73.6
Evangelical Lutheran Christian-Wisconsin Synod	66.0
Evangelical Lutheran Christian in America	71.3
Other Lutheran	58.2
Seventh-day Adventist	57.0
Christian Schools International	64.0
American Association of Christian Schools	30.7
National Association of Private Schools for Exceptional Children	58.1
Montessori	48.5
National Association of Independent Schools	48.8
All Else	50.3
Total	55.3

SOURCE: Shen, P., Parmer, R., and Tan, A. (1992), op. cit.

reinterviews conducted by phone. Telephone respondents appear to be less likely to refer to records or to arrive at a carefully considered estimate than those who respond by mail.[38]

[36] Paxson, M. (1992). "Follow-up Mail Surveys." Industrial Marketing Management, 21(3), 195-201.
[37] Shen, P., Parmer, R., and Tan, A. (1992). "Characteristics of Nonrespondents in the Schools and Staffing Surveys' School Sample." Proceedings of the Section on Survey Research Methods, American Statistical Association, 452-457. Alexandria, VA: American Statistical Association. See also Jabine, T. (1994). op. cit.
[38] Bushery, J., Royce, D., and Kasprzyk, D. (1992). "The Schools and Staffing Survey: How Reinterview Measures Data Quality." NCES Working Paper Series No. 94-01. U.S. Department of Education, Office of Educational Research and Improvement, Washington, DC: National Center for Education Statistics. See also Jabine, T. (1994). op. cit., 2.10.

Other quality control information based on reinterviews shows that there was a lower response variance for mail respondents who were reinterviewed as part of the quality control experiment by mail.[39] Moreover, in a review[40] of 900 Teacher Survey questionnaires from the 1990 SASS, Jabine concludes

> "The quality of data for mail responses appeared to be much better than that of responses obtained by telephone follow-up. This was attributed in part to the [un]suitability of the questionnaire design and format for telephone interviews, especially when the interviews had to be completed with teachers at their places of work, and in part to failure of the telephone interviewers to follow skip instructions and to complete items correctly and legibly."

The relevance of this view becomes clear when it is remembered (see table 2.3.1) that in 1990-91 SASS about one-third of the public school questionnaires and nearly one-half of the private school questionnaires were completed by telephone.

Table 2.3.3 -- Public School Survey Mail Return Rate as a Percentage of Total Response.

[39] Jabine, T. (1994). op. cit., 2.14.
[40] Jabine, T. (1994). op. cit., 5.15.

(unweighted response rates, in percent)

State	Mail	State	Mail
Alabama	71.1	Montana	64.7
Alaska	60.0	Nebraska	69.5
Arizona	59.9	Nevada	71.6
Arkansas	68.7	New Hampshire	59.3
California	61.3	New Jersey	55.5
Colorado	57.9	New Mexico	60.1
Connecticut	69.2	New York	62.5
Delaware	81.1	North Carolina	69.8
District of Columbia	47.9	North Dakota	67.3
Florida	74.8	Ohio	64.8
Georgia	68.9	Oklahoma	59.2
Hawaii	70.7	Oregon	70.3
Idaho	75.2	Pennsylvania	68.8
Illinois	67.0	Rhode Island	60.7
Indiana	77.6	South Carolina	71.0
Iowa	65.8	South Dakota	63.6
Kansas	68.5	Tennessee	70.6
Kentucky	72.5	Texas	64.4
Louisiana	67.0	Utah	77.0
Maine	71.0	Vermont	75.2
Maryland	72.5	Virginia	79.3
Massachusetts	69.1	Washington	69.3
Michigan	59.2	West Virginia	77.9
Minnesota	61.2	Wisconsin	74.1
Mississippi	67.4	Wyoming	72.2
Missouri	67.8		
		Total	67.3

SOURCE: Shen, P., Parmer, R., and Tan, A. (1992), op. cit.

Teacher Questionnaires-- Complete lists of teachers from both public and private schools were obtained near the beginning of the school year as follows: Advance letters and forms for listing teachers were mailed from the U.S. Bureau of the Census in early October, 1990, to all sample schools with instructions for listing eligible teachers and providing information relevant to the sample selection. Schools which did not respond were contacted by phone and asked to either mail in the information or provide a complete list or a select sample of teachers, as instructed by the field representative, over the phone.

Teacher lists or samples were not provided by 5 percent of the eligible public schools and 10 percent of the eligible private schools. No teachers were selected for these schools.[41]

[41] Gruber, K., Rohr, C. and Fondelier, S. (1993). 1990-91 Schools and Staffing Survey: Data File User's Manual, Volume I: Survey Documentation, NCES 93-144. U.S. Department of Education, Office of Educational Research and Improvement, Washington DC: National Center for Education Statistics. See also Jabine, T. (1994). op. cit., 5.4.

Questionnaires were mailed to the sample teachers at their schools during January and February of 1991, followed up in February and March by a second questionnaire to teachers who did not respond . Telephone follow-ups to all nonresponding teachers began in March and continued through June 1991.

Nonrespondent teachers were called at their schools during non-teaching hours (8:00 am to 9:00 am and 3:00 to 5:00 pm). The option to reschedule the interview was offered to teachers unable to be interviewed at those times. A procedure for conducting telephone follow-up interviews with teachers by calling them at their homes was not adopted, but recommended for future SASS efforts.

For teachers not identified by name, the questionnaires were mailed to the principal. In case of nonresponse, the principal was instructed to request the nonrespondent teacher to call the field representative to complete the interview.

School coordinators to assist with the distribution of questionnaires for the Teacher Survey and the follow-up of nonresponding teachers were not used in the 1990-91 administration of SASS. This was done in the first round of SASS but was not continued in order to protect the identity of the sample teachers in each school and the confidentiality of the data they were providing in the survey.[42]

The Teacher Demand and Shortage Questionnaire for Public Districts-- For the Teacher Demand and Shortage Sample, advance letters were mailed to district superintendents for the sample LEAs in the late fall of 1990. They were informed of the intent for SASS data collection and were requested to designate a staff member to take responsibility for completing the questionnaire. The survey questionnaires were mailed out to the designated persons in December 1990 and January 1991.

A second questionnaire was mailed out to nonrespondents 5 weeks later. For nonrespondents to the second mailing the U.S. Bureau of the Census attempted to complete the questionnaires with telephone follow-ups. A few LEAs refused to participate and specifically requested NCES not to ask schools in their district to participate. Some of the states with the lowest response rates were ones where this occurred.[43]

Other Data Collection Considerations-- There are indications from reviewing questionnaires that the time required to complete a questionnaire might be contributing to nonresponse. Data on this is partial, however; in fact, questionnaire completion times are available only for the private component of the School Survey, the Teacher survey (both public and private) and the Teacher Demand and Shortage Survey.[44] Nonetheless, while incomplete, the evidence is suggestive that

[42] Jabine, T. (1994). op.cit., 5.6.

[43] It should be noted that some schools in nonresponding districts still participated; but at a lower rate than average.

[44] In each of these surveys, there were direct questions, included in the questionnaires, on questionnaire completion times, not counting interruptions.

one of the possible reasons for nonresponse is the length (or difficulty) of the questionnaire. In any case, the aggregate overall statistics are as follows:

-- For the Private School Questionnaire the median time for completion was 60 minutes with an interquartile range of 50 minutes. For about 90 percent of all schools, the questionnaire was completed in less than 2 hours and 10 minutes and for 1 percent it took more than 5 hours.

-- For the Teacher Questionnaire the median time for completion was 45 minutes for public school teachers and 40 minutes for private school teachers, with interquartile ranges of 30 minutes for both groups. About 99 percent of all teachers completed the questionnaire in less than 2 hours.

--For the Teacher Demand and Shortage Questionnaire the median time for completion was 1 hour and 15 minutes, with an interquartile range of 90 minutes. About 5 percent of the districts required more than 5 hours to complete the questionnaire and 1 percent required more than 10 hours.

Table 2.3.4 -- Time required to complete the questionnaire.

Survey	Median Completion Time
School Survey, Private Schools	60 minutes
Teacher Survey	45 minutes (public) 40 minutes (private)
Teacher Demand and Shortage Survey	75 minutes

SOURCE: Jabine, T. (1994), op. cit.

2.4 Nonresponse Adjustment Procedures

Sample weighting adjustments for nonresponse devised by the U.S. Bureau of the Census are based on "intuitive analytic judgment[45]" and use frame variables to capture variability in schools and, by extension, in nonresponse. For each survey, the sample is partitioned into mutually exclusive and exhaustive cells on auxiliary frame variables and a noninterview adjustment factor is calculated for each cell. This is set equal to the inverse of the adjusted weighted response rate.[46] Under prespecified conditions the cells might be collapsed.[47]

This procedure aims at reducing bias without overly increasing the sampling variance. It rests on the premise that within-cell differences between respondents and nonrespondents are

[45] Kasprzyk, D. (1994). "The Schools and Staffing Survey: Rsearch Issues."Proceedings of the Section on Survey and Research Methods, American Statistical Association.Alexandria, VA: American Statistical Association.
[46] U.S. Bureau of the Census (1991). "1991 SASS Recommendations." U.S. Bureau of the Census (1992). "1992 SASS Pretest: Supervisor's Comments."
[47] When the number of respondents is small or the adjustment factor is large.

small and that that they could be large between cells. The procedure has the advantage of simplicity and familiarity, although cell collapsing rules at times appear cumbersome.

Definition of Response Rates -- The response rate used in the calculations is the final response rate; no distinction is made between direct and follow-up response. In adjusting for nonresponse, no distinction is made for refusals, inability to participate, not-at-school (inaccessibility), untraced elements or records deleted because they fail to satisfy edit constraints.[48] Although studies[49] emphasize the usefulness of these distinctions, in SASS nonresponse adjustments are on an overall basis. The need to make such distinctions may be particularly pertinent for the Teacher Survey, given the limited access that teachers have to telephones in many schools.[50]

For each SASS component, the response rate was calculated by first excluding all out-of-scope schools. For the teacher surveys, the base for each of the teacher response rates was the number of sample teachers who turned out to be eligible for the Teacher Survey. This excludes all teachers in schools that did not provide lists for sampling and it excludes school staff who were sampled but did not turn out to meet the survey definition of teacher or were no longer teaching at the sample school at the time the questionnaires were distributed.

In general, for the teacher survey questionnaires, in-scope teachers were classified as respondents if all of the following conditions were met: 1) the teacher reported the year that he or she started working as an elementary or secondary teacher; 2) at least one part of the educational background section had an acceptable response; 3) the teacher reported his or her main assignment field and whether or nor he or she was certified in that field; 4) the teacher reported at least one grade level of students currently being taught by him or her; or, there were responses for at least 30 percent of the remaining items that a teacher should complete. If one or more of these conditions was not met then the in-scope teacher was classified as a nonrespondent.

[48] That is, some questionnaires were classified as nonresponse cases because of an unacceptably high number of unanswered items. In a few cases, questionnaires were rejected in the edit and the schools and treated as nonrespondents. This could happen if values were missing or out of range for selected key items.

[49] Schneider, K. (1990). "Differences Between Nonrespondents and Refusers in Market Surveys Using Mixed Modes of Contact." Journal of Business Research 21(2), 91-107.

[50] U.S. Bureau of the Census (1991, 1992). op cit.

School Nonresponse Adjustment Factors -- For all but the Teacher Surveys, nonresponse adjustment involves a one-step calculation based on the inverse of the response rate.[51]

The school nonresponse adjustment factor (S_i for the i^{th} cell) is defined by the simple expression, shown below, as the ratio for a given cell of the weighted number of respondents (RS_i for the i^{th} cell) and nonrespondents (NS_i for the i^{th} cell) combined (in the numerator), divided by just the weighted number of respondents (in the denominator). The formula is

$$S_i = (RS_i + NS_i)/ RS_i$$

where, as noted already,

RS_i = sum of adjusted base weights of responding schools or administrators or LEAs in the i^{th} cell; and,

NS_i = sum of adjusted base weights of schools or administrators or LEAs eligible for a questionnaire but not responding in the i^{th} cell.

The base weights are the inverses of the design probabilities of selection. They are adjusted in order to reflect some unusual circumstances affecting the selection of the school, administrator, or LEA in question -- these usually relate to mergers or splits or to problems with school selection in California.

For the Teacher Surveys, the nonresponse rate reflects both losses from schools which did not supply teacher lists (adjusted with the nonresponse adjustment factor) and nonresponding teachers from schools that did supply lists (adjusted with the teacher-within-school noninterview factor). As a composite, the teacher nonresponse rate tends to be higher than for the other surveys.

The combined teacher nonresponse adjustment factor (C_i for the i^{th} cell) is defined as the product of the school nonresponse adjustment factor (S_i) and the teacher-within-school nonresponse factor (T_i for the i^{th} cell). Using notation similar to that employed above, let

$$C_i = (S_i)(T_i)$$

where, as before, the School Nonresponse Adjustment Factor is

$$S_i = (RS_i + NS_i)/ RS_i .$$

This time

RS_i = sum of weights of schools that provided a teacher listing form in the i^{th} cell; and,

[51] U.S. Bureau of the Census (1991). op cit.

NS_i = sum of weights of schools that did not provide a teacher listing form in the i^{th} cell.

Again, the weight used is the basic weight adjusted to account for some unusual circumstances affecting the school's probability of selection.

The teacher-within-school portion of the nonresponse adjustment is defined in a manner similar to the school factor as

$$T_i = (RT_i + NT_i)/RT_i$$

with

RT_i = sum of weights of responding teachers in the i^{th} cell; and,

NT_i = sum of weights of teachers eligible for a questionnaire but not responding in the i^{th} cell.

For the teacher surveys, the fraction that each of these two types of nonresponse is to the total is shown in table 2.4.1. This table does not present the overall level of nonresponse (just the fraction of nonresponse arising at the school or teacher stage). The overall nonresponse rates by SASS component are left to the next section (see table 2.5.1) and to later chapters in this report.

Table 2.4.1 -- Fraction of Overall Nonresponse for Teacher Surveys due to School or Teacher nonresponse.

(Nonresponse expressed as a fraction of the total, in percent)

School Sector	School Nonresponse Fraction	Teacher Nonresponse Fraction	Total Nonresponse Overall
Public	36	64	100
Private	40	60	100

SOURCE: Adapted from Jabine, T. (1994), op. cit., 5.20, table 5.1.

Choice of Variables for the Definition of Adjustment Cells- The success of adjustments for unit nonresponse in reducing bias depends on the extent to which the characteristics of units that respond and do not respond are similar. Nonresponse adjustment procedures for the 1990-91 SASS are at the macro-level and take into account the sampling design and sample allocation methodology for SASS. The choice of variables rests on the implicit premise that they covary with nonresponse.

For the public school surveys (see table 2.4.2), nonrespondent adjustment groups are defined, initially, as follows: Bureau of Indian Affairs schools, High Percentage Native American schools, schools in Delaware, Nevada and West Virginia; and all other schools. This is the order

in which schools are assigned to a stratum group. Within each group, the schools are further classified within state by grade level into elementary, secondary, and combined schools.

For the private schools (see table 2.4.2), in the list sample, the first level of grouping is school association membership. Within each association membership, schools were further classified by grade level (elementary, secondary, combined) and within each membership association/grade schools by the four Census regions (Northeast, Midwest, South and West).

Table 2.4.2 -- Current nonresponse adjustment procedures for School and Administrator Surveys.

	Public Schools	Private List Frame	Private Area Frame
	Adjustment cells: state by grade level by enrollment size by urbanicity	Adjustment cells: association by grade level by urbanicity*	Adjustment cells: association** by grade level by enrollment size
	Collapsing Order: enrollment size urbanicity grade level	Collapsing Order: urbanicity* grade level association	Collapsing Order: enrollment size grade level association

* For Catholic and All Else Associations only.
** With four categories: Catholic, other religious, nonsectarian and unknown.

SOURCE: Kaufman, S. and Huang, H. (1993), op. cit.

For the Teacher Surveys (see table 2.4.3), teachers were stratified by type and then field of teaching to assure a good distribution of teachers by this variable. For the Teacher Within-School Noninterview Adjustment, only one of the variables, that corresponding to teacher type, is used as a stratum in the survey design. Teacher size class, urbanicity or association are frame variables which do not enter directly into the SASS design.

Table 2.4.3 -- Current nonresponse adjustment procedures for Teacher Surveys.

Public Schools	Private Schools List Frame	Private Schools Area Frame
	School Nonresponse	
Adjustment cells: state by grade level by teacher size class by urbanicity	Adjustment cells: association by grade level by urbanicity*	Adjustment cells: association** by grade level by teacher size class
Collapsing Order: teacher size class urbanicity grade level	Collapsing Order: urbanicity* grade level association	Collapsing Order: teacher size class grade level association
	Teacher Nonresponse	
Adjustment cells: state by field of teaching teacher type by urbanicity***	Adjustment cells: association by field of teaching by experience level by urbanicity*	Adjustment cells: association** by field of teaching
Collapsing Order: urbanicity teacher type field of teaching	Collapsing Order: urbanicity* teaching experience field of teaching association	Collapsing Order: teaching experience field of teaching association

* For Catholic and All Else Associations only.
** With four categories: Catholic, other religious, nonsectarian and unknown.
*** For experienced teachers only.

SOURCE: Kaufman, S. and Huang, H. (1993), op. cit.

For the public Teacher Demand and Shortage (TDS) survey, table 2.4.4 sets out the adjustment cells.

Table 2.4.4 -- Current nonresponse adjustment procedures for Teacher Demand and Shortage Survey.

LEAs With Schools	LEAs Without Schools
Adjustment cells: state by LEA enrollment size by metropolitan status	Adjustment cells: state by LEA metropolitan status
Collapsing Order: enrollment size by metropolitan status	Collapsing Order: metropolitan status

SOURCE: Kaufman, S. and Huang, H. (1993), op. cit.

2.5 Summary of Operational Issues Involving SASS Response

In this Chapter, the nature of the SASS sample design and estimation have been covered. Here, in the concluding section, it might be well to summarize what has been said and to draw out some of the implications, both in terms of SASS operations and in terms of the impact that the procedures may have on research uses of the survey results.

Overall response rates -- The survey practitioners, in their execution of the surveys which make up SASS, focus on unweighted response rates. For analysts, the more appropriate rates are weighted and this is what will be used in Chapters 3 and 4. However, for the 1990-91 SASS, it turns out that these two different ways of looking at response yield similar figures. This can be seen in table 2.5.1.

Table 2.5.1 -- Weighted and Unweighted Response Rates Compared.

(In Percent)

Component	Unweighted	Weighted
School Survey		
Public.....	95.07	95.30
Private.....	85.06	83.95
School Administrator Survey:		
Public.....	93.42	96.68
Private.....	91.14	90.05
Teacher Survey:		
Public.....	91.44	90.33
Private.....	83.06	84.31
Teacher Demand and Shortage Survey.....	93.69	93.49

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public and Private Administrator, School, and Teacher Questionnaires; Teacher Demand and Shortage Questionnaires).

A concern that could arise in a future SASS would be what to do if the two response rates deviated to any great extent. But types of rates have a value in planning for the next survey, while the weighted figures are crucial in making resource decisions and adjustments to produce the best

estimates possible in the current survey. The current nonresponse adjustment procedure nicely reflects this distinction; however, earlier management actions are guided largely by the unweighted response rates, and it might have been better to use both.

Typical U.S. Bureau of the Census practice differs in the use of nonresponse information, as between business surveys, like the Annual Survey of Manufactures, where weighted response rates are employed operationally and household surveys, like the Current Population Survey, where they are not.[52] Of course, the inverse of the probability of selection is not the only factor that might be used to weight respondents and nonrespondents. Weighting, say by some important variable (e.g., student enrollment in the SASS application), might be used. This approach in SASS is discussed more in Appendix B.

SASS is a hybrid effort, and could profit from both the practices in establishment and household surveys -- by using, say, two measures of nonresponse operationally. Fortunately, this would have made little difference in the 1990-91 SASS.[53]

Preventing Nonresponse -- Numerous steps are now taken in SASS to reduce nonresponse. These range from advance letters to several follow-up steps, some by mail and some by phone -- all in an attempt to secure a response. Still more might be done, for example, the length of the interview could be looked at -- to see if it could be shortened. Don Dillman has done some important work on making self-reported Census mail survey questionnaires more "user friendly." Could his approach be tried on a future[54] SASS?

Extensive efforts have been made by the Bureau of Labor Statistics in changing the mode of data collection to fit the respondent, as in is the use of touch-tone data collection. Another possible mode of data collection is the use of FAX (even Internet) responses to a limited set of questions after two follow-ups. Another consideration, especially for the largest schools, might be exploring a way to electronically tap into the administrative data of at least some of the sampled schools directly. And a final alternative mode to consider may be having the U.S. Bureau of the Census go to a sample of the nonresponding schools, especially the large ones, to complete the needed survey schedules. Recent research shows that an in-person request can make a notable improvement in self-reported mailback questionnaires.[55]

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[52] For example, as described in the article on the Federal Committee on Statistical Methodology Study of Nonresponse, April 1994, AMSTAT NEWS. See Chapter 1, footnote 3 for more details.

[53] See the basic response rate tables in Appendix B, for how alternative measures turn out in detail.

[54] In point of fact, this was at least partially attempted in the 1993-94 SASS which redesigned the question flow, how the items were arranged on the page, and made front cover improvements, etc. See also Dillman, D., Sinclair, M., and Clark, J. (1992), "The Simplified Questionnaire Test: Effects of Questionnaire Length, Respondent Friendly Design, and Request for Social Security Numbers on Completion Rates." *Proceedings of the 1993 Annual Research Conference*, Bureau of the Census. Jenkins, C. and Dillman, D. (1995). "The Language of Self-Administered Questionnaires As Seen Through the Eyes of the Respondents." Seminar on New Directions in Statistical Methodology, Part 3, Federal Committee on Statistical Methodology.

[55] See for example, Dillman, D., Dolseh D., and Machlis, G. (1995). "Increasing Response to Personally-delivered Mail-back Questionnaires." *Journal of Official Statistics*, 11(2), 129-139. See also a selection of other work by Dillman including, "The Importance of Adhering to Details of the Total Design Method (TDM) for Mail Surveys;" "Mail Surveys: A Comprehensive Bibliography, 1974-1989;" and "Methods for Improving Response to Establishment Surveys." Also, Self-administered/mail surveys, a survey methodology course by Don Dillman,

It seems to be crucial here to establish a very small, probably annual, "SASS Methods Survey" that tracks the changing record practices of schools and finds ways to ease the work of responding by fitting the survey vehicle to the respondent.[56] An ongoing experimental program could aid not only in reducing nonresponse but also in understanding what its impact was when nonresponse occurs. Consideration also needs to be given to changing, even eliminating, the area frame in the private sector components of SASS. At present the attempt to improve coverage is being bought with a high price in terms of additional nonresponse. More will be said on this in Chapter 5.

Adjusting for Nonresponse -- At present, the approach in SASS to the nonresponse adjustment is to form cells that are thought to be homogeneous with respect to characteristics of responding and nonresponding units (schools or administrators or teachers or LEAs). This is fine, as far as it goes, but does not really capture the full information available on the sampling frames being used.

Again, SASS is a hybrid and could profit from an examination of the nonresponse adjustment methods of U.S. Bureau of the Census establishment surveys which use frame information much more aggressively.[57] The Statistics Canada practice of mass imputation also warrants study, as does the approach being pioneered by Schafer and his colleagues at the National Center of Health Statistics.[58] Ideas from U.S. Bureau of the Census household surveys may also turn out to be worth a look --- notably, the introduction of control totals for the survey year being estimated. Here there are lots of options from better synchronization of CCD and SASS, to only doing SASS in years when the Private School Survey is also conducted.[59] These points will be developed further in Chapter 5 when overall recommendations are made.

Joint Program on Statistical Methodology, University of Maryland, April 1993. This course is an update on Dillman, D. (1978). Mail and Telephone Surveys, The total Design Method. New York: Johm Wiley and Sons, Inc. See also the series of papers on Data Processing in Business Survey Methods (Cox et al 1995, op. cit.), especially Piekzchala, M., Editing Systems and Software.

[56] Nanapoulos, P. (1995). "Expected Changes in Record Keeping." The Future of Statistics, 199-227. Voorburg, the Netherlands.

[57] In establishment surveys, there is often available a fairly timely record of the nonresponding sampled unit. In this case, partial substitution and item imputation techniques are sometimes attempted. For more details, see Greenberg, B. (1990). "SPEER (Structured Program for Economic Editing and Referrals)." Proceedings of the Section on Survey Research Methods, American Statistical Association, pp 95-104. Alexandria, VA: American Statistical Association.

[58] There is more discussion of these ideas in Scheuren, F. (1995). "Administrative Record Opportunities in Education Survey Research." A paper presented at The Future of Education Statistics Conference, November 27 to 29, 1995.

[59] See Scheuren, F. (1995). op.cit. Also Li, B. and Scheuren, F. (1996). "GLS Estimators in the 1993-94 SASS Private School Component." NCES Working Paper Series, available June 1996. U.S. Department of Education, Office of Educational Research and Improvement, Washington DC: National Center for Education Statistics.

Chapter 3 Descriptive Analysis of SASS Response Rates

3.1 Introduction

This Chapter presents a descriptive analysis of response rates for the 1990-91 Schools and Staffing Survey (SASS). Seven of the SASS components are looked at -- along with an overall summary. In the previous Chapter, response rates were examined from an operational perspective, in terms of survey activities. Here the focus is on the impact of nonresponse on survey analysis -- where the greater the nonresponse, naturally, the greater the need for caution in interpreting SASS results.

Organizationally, the Chapter begins with this introduction (Section 3.1), then takes up each SASS survey component in its own section: Public Schools (Sec 3.2), Private Schools (Sec 3.3), Public School Administrators (Sec 3.4), Private School Administrators (Sec 3.5), Public School Teachers (Sec 3.6), Private School Teachers (Sec 3.7), Public School Teacher Demand and Shortage (Sec 3.8). Section 3.9 concludes the chapter with a summary view of all the SASS components.

The sections are fairly uniform in their approach and are intended to be read separately. First, there is an examination of response rates at the national level; this is followed in every case by a more detailed look at the data regionally. For the public school components, there are also the beginnings of a state-by-state analysis; in the case of private schools, a start is made on an analysis by school association.

These descriptive analyses are preliminary and aimed at identifying and exploring basic, broad patterns in response. Unlike in Chapter 2, the analysis is carried out using weighted response rates.[60] Emphasis is placed on four categorical dimensions: Urbanicity, School level, School size, and (geographical) Census Region. The one exception is the Teacher Demand and Shortage Survey (TDS). The different levels for each of the variables considered are as follows:

1. Urbanicity (urban fringe/large town, central city, and rural/small town);
2. School level (secondary, elementary, combined);
3. School size (1-149, 150-499, 500-749, 750 or more);
4. Region (Midwest, Northeast, South and West); and,
5. State for public sector surveys and Association for private sector surveys.

[60] The weights used are the inverses of the probabilities of selection of the schools or LEAs in the sample. See Appendix B for more on the specification of the weights used and possible alternatives.

For the TDS the emphasis is on the four categorical dimensions: Urbanicity (different from the other 6 components), Number of Schools in the Local Education Agency (LEA), Number of Students in the LEA, and (geographical) Census Region. The different levels for each of the variables considered for TDS are as follows:

1. Urbanicity (central city of a metropolitan statistical area (MSA), not central city of a MSA, outside MSA)
2. Number of schools in LEA (0-4 schools, 5 or more schools)
3. Number of students in the LEA (0-299, 300-599, 600-999, 1,000-2,499, 2,500-4,999, 5,000-9,999, 10,000-24,999, 25,000 or more students)
4. Region (Midwest, Northeast, South and West).

The analysis begins by looking at patterns and variation in response rates for each categorical variable separately. The analysis then concerns itself with regional patterns and considers the combined effect of each categorical variable and region. Higher level or other interactions (combined effect of two or more categorical variables) do not enter into the discussion.

Response rates for each component are tabulated in a series of basic tables, shown in Appendix B at the end of this report. All of these tables follow the same format. The rows show the overall weighted response rate, as well as weighted response rates for urbanicity, school level, and school size. Each table begins with a U.S. total. For the public sector samples, states are then listed, one to a row, in alphabetical order and response rates given by urbanicity, school level, and school size. For the private sector samples, the tables are the same, except that association replaces state. Finally, at the bottom, response rates are shown by census region. Dashes denote unknown or not applicable.

Consistent with the interest in overall regional response rates, there are a series of map summaries accompanying the discussion. In addition maps show response rates by urbanicity, a frame variable which often turned out to be statistically significant. The approach in this chapter is to describe aspects of the results which appear to be interesting and then to test them for significance individually[61]. A global discussion of the overall significance of specific variables is deferred to Chapter 4.

High response rates that vary only slightly across the classifiers are desirable properties sought in the data. In each section of the descriptive analysis the highest and lowest response rates are noted, giving the maximum and minimum occurrences of nonresponse. In addition, large

[61] A difference is said to be statistically significant in this report if it reaches the nominal 90 percent level. This will be the basic standard of comparison throughout this Chapter when commenting on the weighted response rate patterns. Bonferroni methods will be employed, as in Ahmed, S. (1992). "Issues Arising in the Application of Bonferroni Procedures in Federal Surveys." Proceedings of the Section on Survey Research Methods, American Statistical Association. Alexandria VA: American Statistical Association. This means that for a single 90% test of significance between two stipulated response rates t=1.645. When looking at all possible comparisons among three groups (as with urbanicity or school level), the t-value needs to be increased to t=2.125. For comparisons by school size, where there are 4 groups, the t-value grows to 2.394 (and so on).

variations in response rates are reported in an attempt to capture major trends and single out subpopulations with undesirably high variability in response.

3.2 SASS Public School Component

The overall weighted response rate for the 1990-91 SASS Public School Component was 95.30 percent. The response rates for urbanicity showed a range[62] of almost five percentage points; rural schools had the highest response rate at 97.51 percent, while central city schools showed the lowest at 92.59 percent. Schools in the urban fringe or in large towns had a response rate close to that of the central cities, at 93.52 percent.[63]

The range of response rates by school level was quite small and probably unimportant, at just over one percentage point. Secondary schools had the highest response rate (at 95.51 percent), while combined schools showed the lowest (94.12 percent) with elementary schools being intermediate (95.31 percent).[64]

School size showed a response rate range of just over four percentage points. Schools with 1-149 students had the highest response rate (at 97.14 percent). The response rates then declined consistently -- first to 95.79 percent for schools with 150 to 499 students, then to 94.90 percent for schools with 500 to 749 students. Schools with 750 or more students had the lowest response rates at 92.96 percent.[65]

Response Rates by Region. --Overall response rates by region varied by roughly six percentage points. The Midwest region had the highest response at 97.64 percent while the Northeast had the lowest at 91.59 percent. The South and the West regions had almost identical response rates with 95.24 percent and 95.14 percent respectively.[66]

As can be seen in table 3.2.1 the Midwest region had five of the top ten highest responding States, including the highest three. On the other hand, out of the ten lowest responding states, four were in the Northeast region, four in the South region, and two in the West region.

Table 3.2.1 -- Ten highest and lowest weighted response rates by state: Schools and Staffing Survey 1990-91, Public School Component.

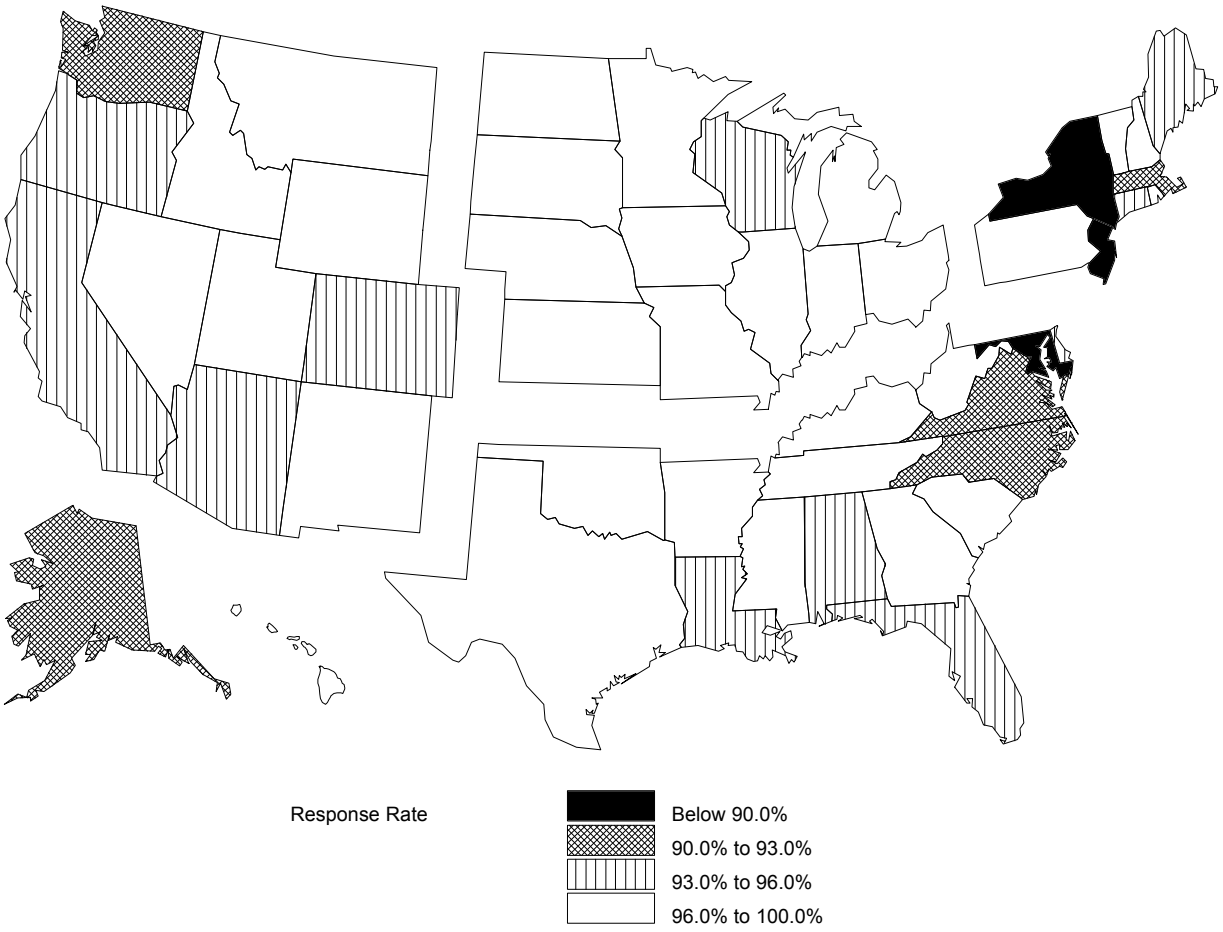
[62] This range was large enough to be highly significant statistically at the nominal 90% level.
[63] The difference in response rates between schools in the central city versus those in the urban fringe/large towns was not statistically significant.
[64] The difference in national response rates by school level is not statistically significant.
[65] This pattern of consistent decline is statistically significant and may have operational significance too -- a point to be brought out in the recommendations made in the concluding chapter of this report.
[66] The Northeast region is statistically significantly different from the remaining regions.

(In Percent)

State	Highest Response Rate	Region	State	Lowest Response Rate	Region
Indiana	99.61	Midwest	Maryland	80.99	South
Illinois	98.72	Midwest	District of Columbia	86.26	South
Nebraska	98.69	Midwest	New York	87.62	Northeast
Hawaii	98.67	West	New Jersey	88.31	Northeast
Idaho	98.62	West	Massachusetts	91.14	Northeast
South Dakota	98.52	Midwest	Alaska	92.00	West
Vermont	98.48	Northeast	Virginia	92.21	South
Utah	98.40	West	Washington	92.58	West
North Dakota	98.37	Midwest	North Carolina	92.63	South
West Virginia	98.20	South	Connecticut	93.10	Northeast

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure 3.2.1 Overall weighted response rates for Public Schools Schools and Staffing Survey 1990-91, Public School Component.



NOTE: The District of Columbia, at 86.26 percent, has not been shown separately.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Urbanicity. -- The urbanicity response rates by region were all above 90.00 percent with the exception of central city schools for the Northeast (85.18 percent). Table 3.2.2 below summarizes these regional differences.

Table 3.2.2 -- Weighted response rates by urbanicity and region: Schools and Staffing Survey 1990-91, Public School Component.

(In Percent)

Census Region	Central City	Urban Fringe/ Large Towns	Rural/ Small Towns
Midwest	96.15	96.08	98.70
Northeast	85.18	90.11	96.29
South	93.69	92.32	97.26
West	92.60	95.46	96.58

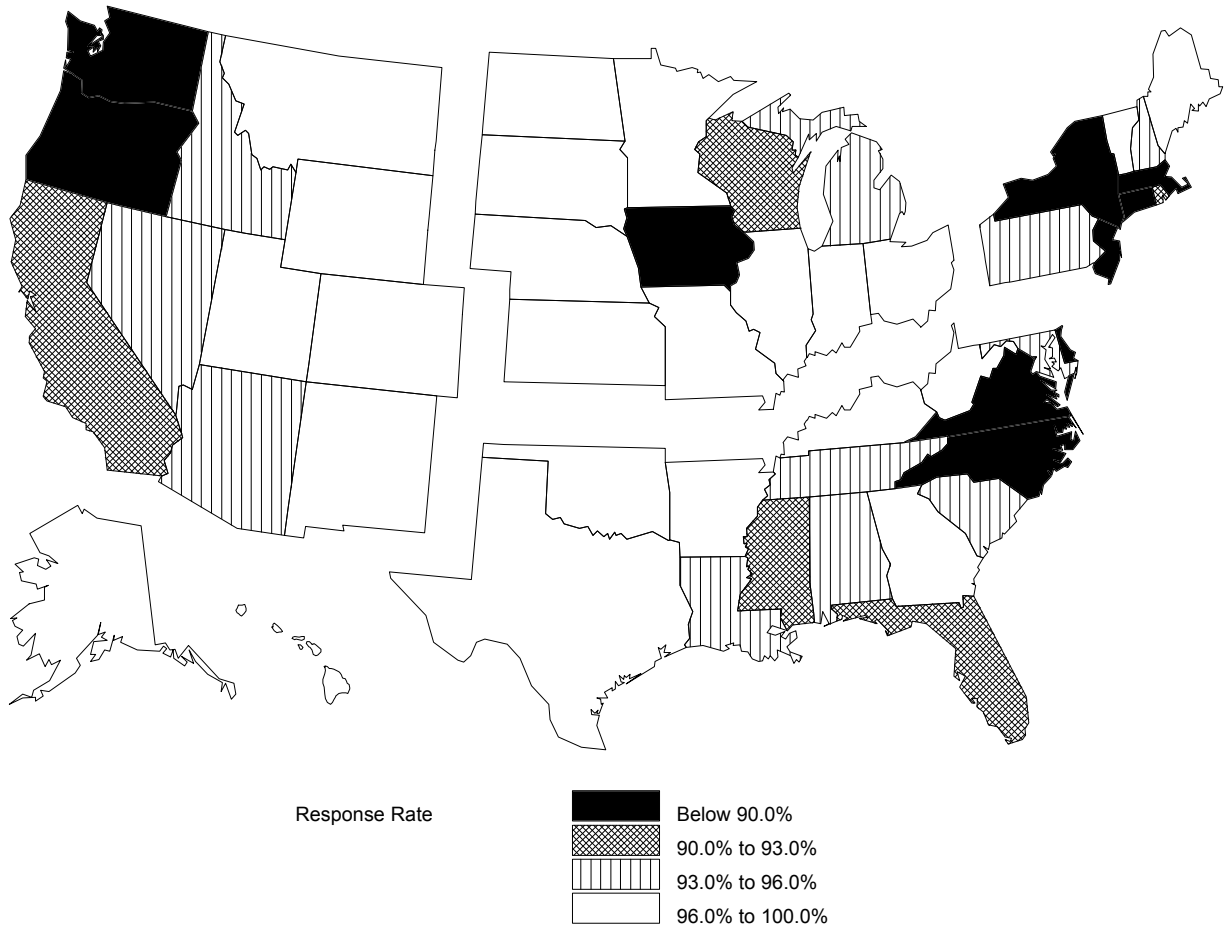
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Notice that there are large regional differences in response rates for central cities by region (where the range is about 11 percent), somewhat smaller differences for the urban fringe/large town schools by region (where the range is about half as great, at six percent), and only slight differences by region for rural/small town schools (with a range half again as small, at about 2.5 percent). Put another way, for this component of SASS, rural schools everywhere were uniformly good responders. In the Midwest, for all types of areas, response rates were good. In the South and West, while they were good in rural areas, they were only intermediate in the central cities and urban fringe/large town schools. In the Northeast, the response rates were the poorest in all three types of areas.[67]

On the pages which follow, response rates are examined further by urbanicity. These state and region maps provide a deeper understanding of the patterns seen in table 3.2.2. Figures 3.2.2 to 3.2.4 show the state response rates separately for central cities (figure 3.2.2), urban fringe/ large towns (figure 3.2.3) and rural/small towns (figure 3.2.4).

[67] Statistically significant differences exist for central city schools by region. The results are not significant for urban fringe/large town schools. A significant difference exists among rural schools in the Midwest and Northeast.

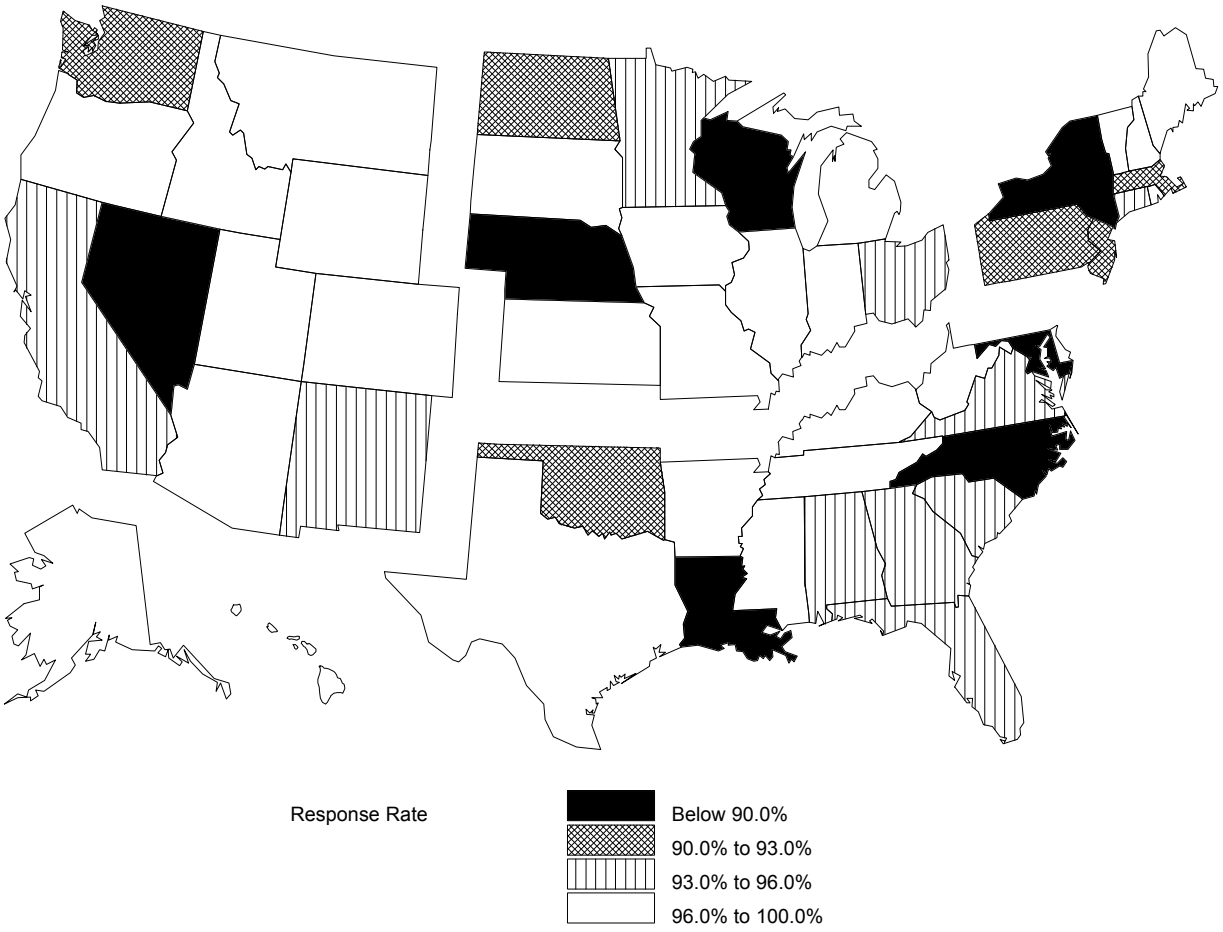
Figure 3.2.2 -- Central city weighted response rates: Schools and Staffing Survey 1990-91, Public School Component.



NOTE: The District of Columbia, at 86.26 percent has not been shown separately.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

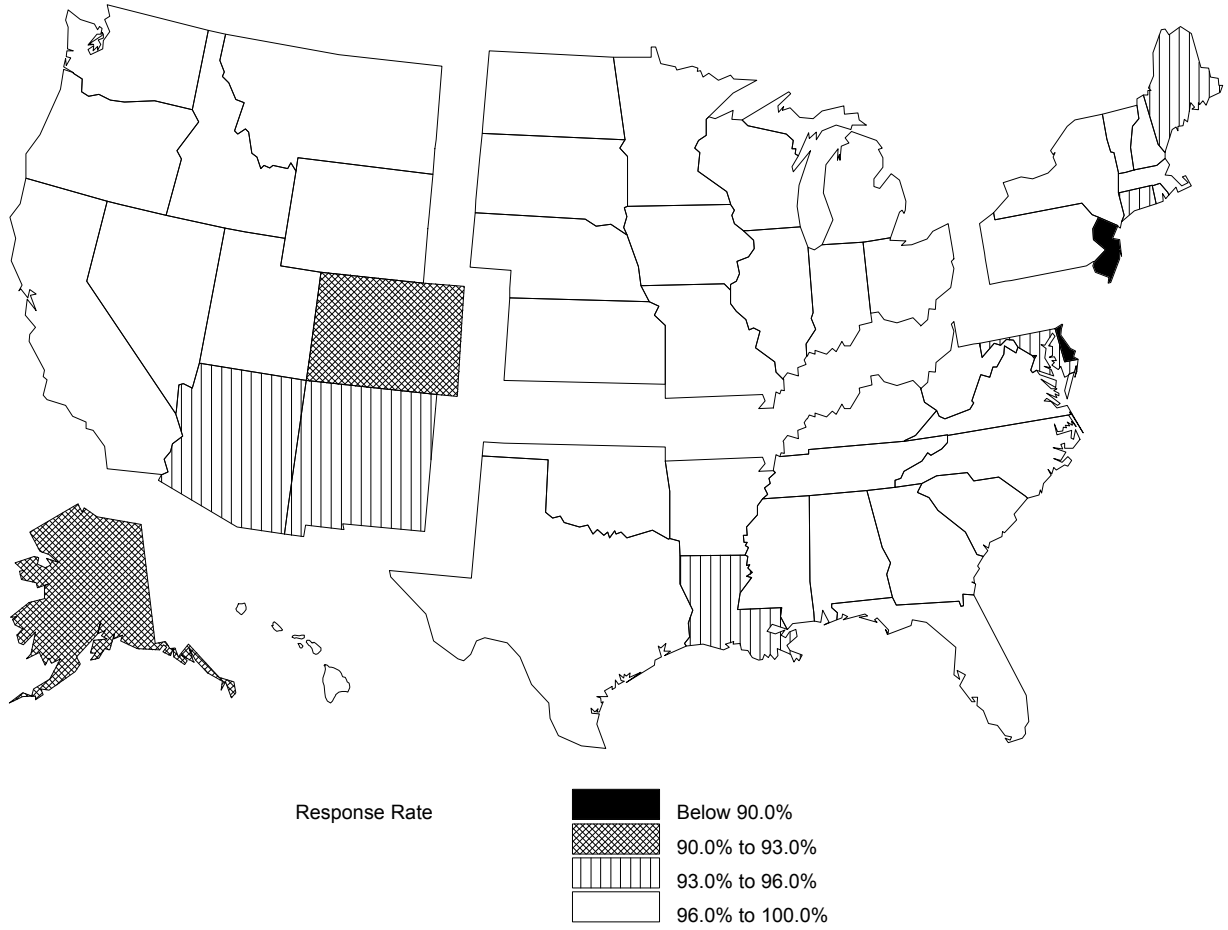
Figure 3.2.3 -- Urban fringe/large town weighted response rates: Schools and Staffing Survey 1990-91, Public School Component.



NOTE: The District of Columbia does not have any urban fringe/large town schools.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure 3.2.4-- Rural/small town weighted response rates: Schools and Staffing Survey 1990-91, Public School Component.



NOTE: The District of Columbia does not have any rural/small town schools.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

School Level and School Size. --As can be seen in table 3.2.3, the school level response rates were all above 90.00 percent with the exception of combined schools for the Northeast (87.77 percent).

Table 3.2.3 -- Weighted response rates by school level and region: Schools and Staffing Survey 1990-91, Public School Component.

(In Percent)

Census Region	Elementary	Secondary	Combined
Midwest	98.12	96.38	98.18
Northeast	91.09	93.92	87.77
South	95.18	95.59	94.65
West	95.20	95.22	93.42

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

While not statistically significant, the Northeast again showed the greatest range in school level response rates at just over six percentage points, while the Midwest, South, and West ranges were less than two percentage points. In the Northeast, South, and West regions, secondary schools had the highest response rate, while combined schools had the lowest; the opposite held for the Midwest region, where combined schools had the highest response rate while secondary schools had the lowest.[68]

[68] None of these differences are statistically significant, although the range for the Northeast is large enough to be on the borderline. The reason it is not is that the number of combined schools in the Northeast is so small.

As for region and school size (see table 3.2.4 below), the response rates were all above 90.00 percent with the exception of schools with 750 or more students from the Northeast (88.35 percent).

Table 3.2.4 -- Weighted response rates by school size and region: Schools and Staffing Survey 1990-91, Public School Component.

(In Percent)

Census Region	1 to 149	150 to 499	500 to 749	750 or More
Midwest	97.62	98.22	97.17	95.14
Northeast	95.33	92.10	91.78	88.35
South	97.62	95.88	94.15	94.23
West	96.67	94.90	96.04	92.90

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

While again not statistically significant, the Northeast showed the greatest range in school size response rates at just over seven percentage points, while response rate range was less than five percentage points in the other three regions.[69] Smaller schools tended to have higher response rates: schools with 1 to 149 students had the highest response rates for the Northeast, the South, and the West, while schools with 150 to 499 students had the highest response rate for the Midwest. Large schools had lower response rates, schools with 750 or more students having the lowest response rates for the Midwest, Northeast, and West, and schools with 500 to 749 students having the lowest response rate for the South.

Response Rates at the State level. --Large variations may be found across individual states. Some states have high, uniform response rates for all categories. Utah might be an example, here. Other states, Alabama for instance, have patterns that parallel those seen nationally. Of course, most states are intermediate -- not easily described by any one simple pattern. Basic table B.22 in Appendix B can be explored to see these and other patterns.[70]

3.3 SASS Private School Component

The overall weighted response rate for the 1990-91 Private School Component of the SASS Survey was 83.95 percent. While not statistically significant, the response rates for urbanicity showed a range[71] of over five percentage points; schools in the urban fringe or in large towns had the highest response rate at 87.41 percent, while rural and small town schools had the

[69] As noted earlier, differences by region are significant and also by size of school, but there does not appear to be a significant difference in the school size effects within regions.
[70] See Appendix A for the statistically significant groupings of states; also Chapter 4.
[71] This range was not large enough to be significant statistically.

lowest at 82.03 percent. Schools in the central cities, at 82.81 percent had roughly the same rate of response as those in rural areas.

The range of response rates by school level was very large and potentially important, at about 14 percentage points. Secondary schools had the highest response rate (at 89.75 percent), while combined schools showed the lowest (75.63 percent) with elementary schools being intermediate (87.63 percent).[72]

School size showed a response rate range of just over seven percentage points. Schools with 150 to 499 students had the highest response rate (at 87.65 percent). The response rates then declined for smaller and larger schools -- to 80.99 percent for schools with 1 to 149 students and similarly to 80.27 percent for schools with 500 to 749 students. Schools with 750 or more students, though, had a fairly high response rate at 86.61 percent.[73]

Overall response rates by region varied by roughly five percentage points. The Midwest region had the highest response at 85.72 percent while the South had the lowest at 80.34 percent. The Northeast and the West regions had similar response rates at 85.33 percent and 84.32 percent respectively.[74]

Urbanicity. -- The urbanicity response rates by region vary greatly, from a high of 93.43 percent for urban fringe/large towns in the Midwest to a low of 78.45 percent in the rural South. Table 3.3.1 below summarizes these regional differences.

Table 3.3.1 -- Weighted response rates by urbanicity and region: Schools and Staffing Survey 1990-91, Private School Component.

(In Percent)

Census Region	Central City	Urban Fringe/ Large Towns	Rural/ Small Towns
Midwest	83.16	93.43	83.43
Northeast	81.90	86.92	87.51
South	79.25	84.61	78.45
West	88.25	84.35	79.25

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

[72] National response rates by school level are statistically significant.
[73] This lack of pattern, even though there is a statistically significant difference between schools with 150 to 499 and 500 to 749 students, is in sharp contrast to public schools and may have operational significance too -- a point to be brought out in the recommendations made in the concluding chapter of this report.
[74] The difference in national response rates by region is not statistically significant.

Notice that, for each type of urbanicity, there are statistically significant differences across regions in response rates for private schools. Interestingly enough, for each level of urbanicity, the range is roughly constant at about 9 percent. In the Midwest, the national pattern holds of high response in the urban fringe/large towns (at 93.43 percent) and a considerably lower but roughly equal response in central cities (at 83.16 percent) and rural/small towns (at 83.43 percent). In the South this national pattern also emerges but at a lower response level in each urbanicity, as can be seen in table 3.3.1 above. The other two regions deviate from the overall pattern, but each in a different way. In the Northeast, for example, it is the rural/small town schools that have the highest response rate (at 87.51 percent) -- while in the West the highest rate is for the central city (at 88.25 percent).

School Level and School Size. --As can be seen in table 3.3.2, the school level response rates were extremely uneven, ranging from a low of 69.37 percent for Midwest combined schools to a high of 92.24 percent for Midwest secondary schools.

Table 3.3.2 -- Weighted response rates by school level and region: Schools and Staffing Survey 1990-91, Private School Component.

(In Percent)

Census Region	Elementary	Secondary	Combined
Midwest	91.40	92.24	69.37
Northeast	86.82	88.31	80.68
South	84.29	88.43	74.33
West	85.78	89.72	80.64

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

The greatest apparent range in school level response rates at just over eleven percentage points occurred for combined schools; the range across region was a lot less for elementary schools (at about seven percentage points) -- while secondary schools had the smallest range (at just under four percentage points).[75]

Response rates by region and school size are shown in table 3.3.3 below. As can be seen, the Midwest again showed the greatest range in school size response rates at just over 14 percentage points. Rates for the South and Northeast were not far behind, however, with ranges at over 11 percentage points each. Even for the West the range was not small (at roughly, seven percentage points).[76] In two regions, the Midwest and Northeast, there appear to be clear patterns of response rates by school size. For the Midwest, rates go up consistently as the schools involved get larger (from 81.22 percent to 95.57 percent). For the Northeast, the pattern is almost the opposite with response rates falling at school size grows (from 86.55 percent to 75.75

[75]The difference in response rates for Midwest and Northeast elementary schools is statistically significant.
[76] Differences in the school size effects within regions, while striking, do not appear to be statistically significant.

percent). In the other two regions, there is no real pattern, the rates bumping up and down as school size changes.

Table 3.3.3 -- Weighted response rate by school size and region: Schools and Staffing Survey 1990-91, Private School Component.

(In Percent)

Census Region	1 to 149	150 to 499	500 to 749	750 or More
Midwest	81.22	90.27	93.96	95.57
Northeast	86.55	86.52	75.94	75.75
South	76.93	84.89	71.69	88.15
West	81.11	88.89	85.24	87.69

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

Response Rates at the Association level. -The data by association reflect considerable heterogeneity in response rates among the private school strata, with a spread of over thirty-five percentage points (see table 3.3.4). Shown in the table are the eighteen list sample strata (plus the entire Area Frame as a group): Ten had response rates below 90 percent, six had response rates between 90 and 95 percent, and three above 95 percent. The lowest strata response rate was for the American Association of Christian Schools (59.03 percent) and the highest response rate was for Evangelical Lutheran Church-Wisconsin Synod (97.89 percent).

Table 3.3.4 -- Weighted strata response rates: Schools and Staffing Survey 1990-91, Private School Component.

(In Percent)

Association	Response Rate
Evangelical Lutheran Church - Wisconsin Synod	97.89
Lutheran Church - Missouri Synod	96.07
Evangelical Lutheran Church in America	95.51
Other Lutheran	94.17
General Council of Seventh-Day Adventists	93.91
Christian Schools International	93.68
National Catholic Education Association, Jesuit Secondary Education Association	90.92
Association of Military Colleges and Schools	90.91
Friends Council on Education	90.63
National Association of Episcopal Schools	89.39
National Association of Private Schools for Exceptional Children	86.49
American Montessori Society Schools	85.46
Solomon Schechter Day Schools	85.11
National Association of Independent Schools	84.60
All Else	81.11
Area Frame	74.03
Hebrew Day Schools	70.76
Other Jewish	70.36
American Association of Christian Schools	59.03

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Surveys 1990-91 (Private School Questionnaires).

Large variations may also be found within individual associations in response rates. Some associations have high, uniform response rates for all categories. Catholic or perhaps some of the Lutheran associations might be examples here. Other associations, the American Association of Christian Schools, for instance, have patterns that are more uneven. In fact, most associations are not easily described by any one simple pattern. (See basic table B.29 in Appendix B for details. See also Appendix A for a general description of the approach taken in determining the statistical significance of association groups.)

3.4 SASS Public School Administrator Component

The overall weighted response rate for the 1990-91 SASS Public School Administrator Component was 96.68 percent. The response rates for urbanicity showed a range[77] of almost five percentage points; rural schools had the highest response rate at 98.46 percent, while central city schools showed the lowest at 93.51 percent. Schools in the urban fringe or in large towns had a response rate about half way between the other two, at 96.19 percent.[78]

The range of response rates by school level was fairly small and possibly of no real importance, at just over 1.5 percentage points. Secondary schools had the highest response rate (at 97.53 percent), while combined schools showed the lowest 95.86 percent) with elementary schools being intermediate 96.42 percent).[79]

School size showed a response rate range that was also fairly small -- of just over two percentage points. Schools with 150 to 499 students had the highest response rate (at 97.15 percent). The response rates then declined for both smaller and larger schools, going down slightly to 96.93 for schools with 1-149 students and to 96.81 for schools with 500 to 749 students. Schools with 750 or more students had the lowest response rates at 94.91 percent.[80]

In summary, urbanicity and school size have differences big enough to be statistically significant; but response rates by school level do not.

Response Rates by Region.--Response rates by Census Region varied by just over four percentage points. The Midwest region showed the highest response rate with 98.62 percent, while the lowest was from the Northeast region with 94.25 percent.[81]

The South and West regions were both within one percentage point of the overall mean, at 96.26 percent and 96.62 percent -- albeit on opposite sides. Among the individual state responses, however, 8 of the 10 lowest response rates were from the South (See Table 3.4.1). Figure 3.4.1 shows in map form the overall response rates by individual state.

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[77] This range was large enough to be significant statistically.

[78] The response rates for central city and urban fringe/large town schools are significantly different from the response rate for rural/small town schools.

[79] Even with the large sample available, the difference in national response rates by school level is not statistically significant.

[80] The response rate for schools with 150 to 499 students is statistically different from the response rate for schools with 750 or more students.

[81] The Midwest region is statistically significantly different form the Northeast, the South, and the West, and the Northeast is statistically significantly different from the West.

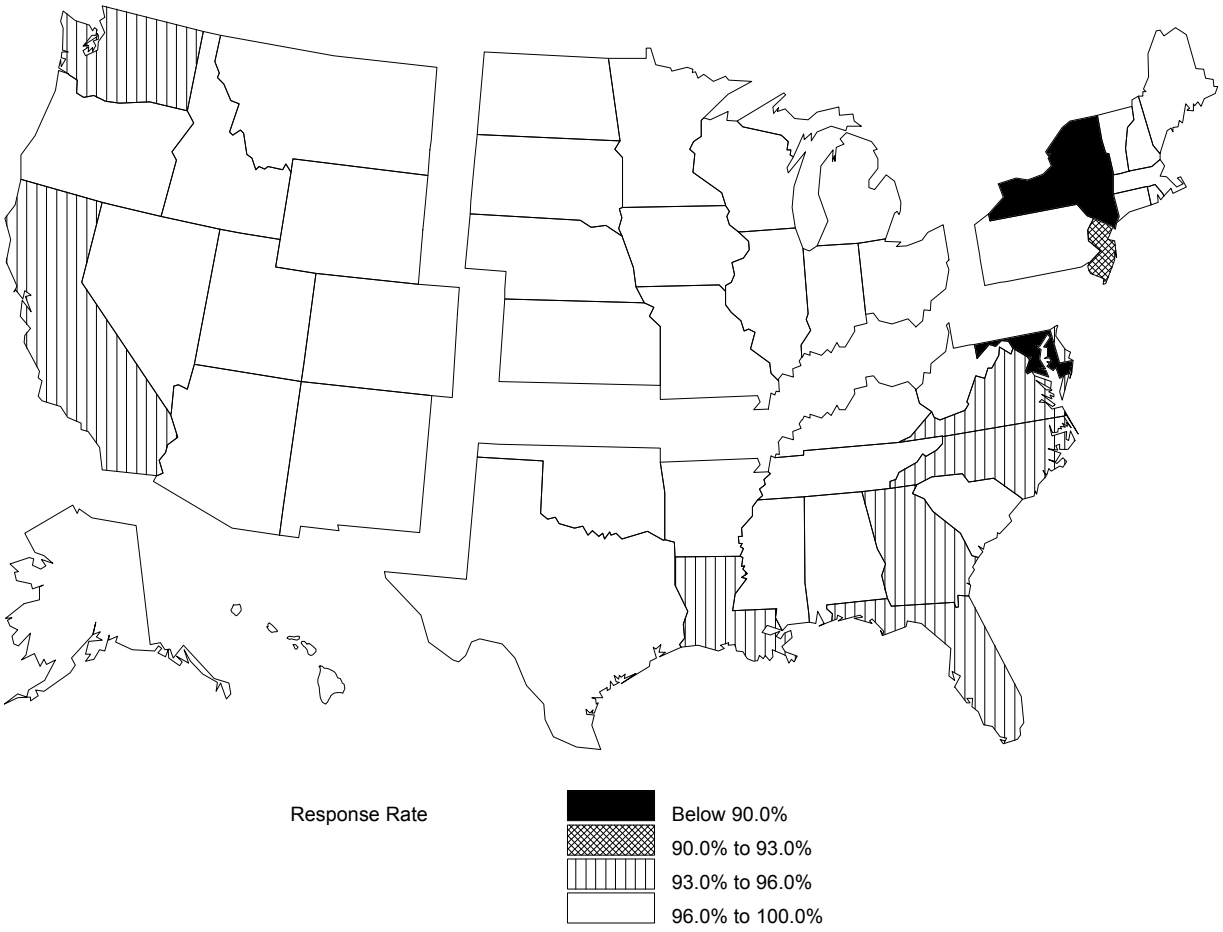
Table 3.4.1 -- Ten highest and lowest weighted response rates by state: Schools and Staffing Survey 1990-91, Public School Administrator Component.

(In Percent)

State	Highest Response Rate	Region	State	Lowest Response Rate	Region
Idaho	100.00	West	Maryland	82.35	South
Indiana	100.00	Midwest	District of Columbia	88.88	South
Illinois	99.85	Midwest	New York	89.51	Northeast
Montana	99.78	West	New Jersey	92.37	South
West Virginia	99.65	South	Washington	93.67	West
Utah	99.34	West	Louisiana	93.68	South
North Dakota	99.15	Midwest	Florida	94.41	South
New Mexico	99.13	West	Delaware	94.44	South
Oklahoma	99.09	South	Georgia	94.79	South
Iowa	99.00	Midwest	Virginia	95.34	South

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Administrator Questionnaires).

Figure 3.4.1 -- Overall weighted response rates: Schools and Staffing Survey 1990-91, Public School Administrator Component.



NOTE: The District of Columbia, at 88.88 percent, has not been shown separately.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Administrator Questionnaires).

Urbanicity. -- Response rates varied considerably when examining differences by urbanicity, as can be seen in table 3.4.2 below.

Table 3.4.2 -- Weighted response rates by urbanicity and region: Schools and Staffing Survey 1990-91, Public School Administrator Component.

(In Percent)

Census Region	Central City	Urban Fringe/ Large Towns	Rural/ Small Towns
Midwest	97.12	98.98	98.96
Northeast	87.77	93.73	98.17
South	93.71	94.44	98.33
West	93.68	97.52	97.94

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Administrator Questionnaires).

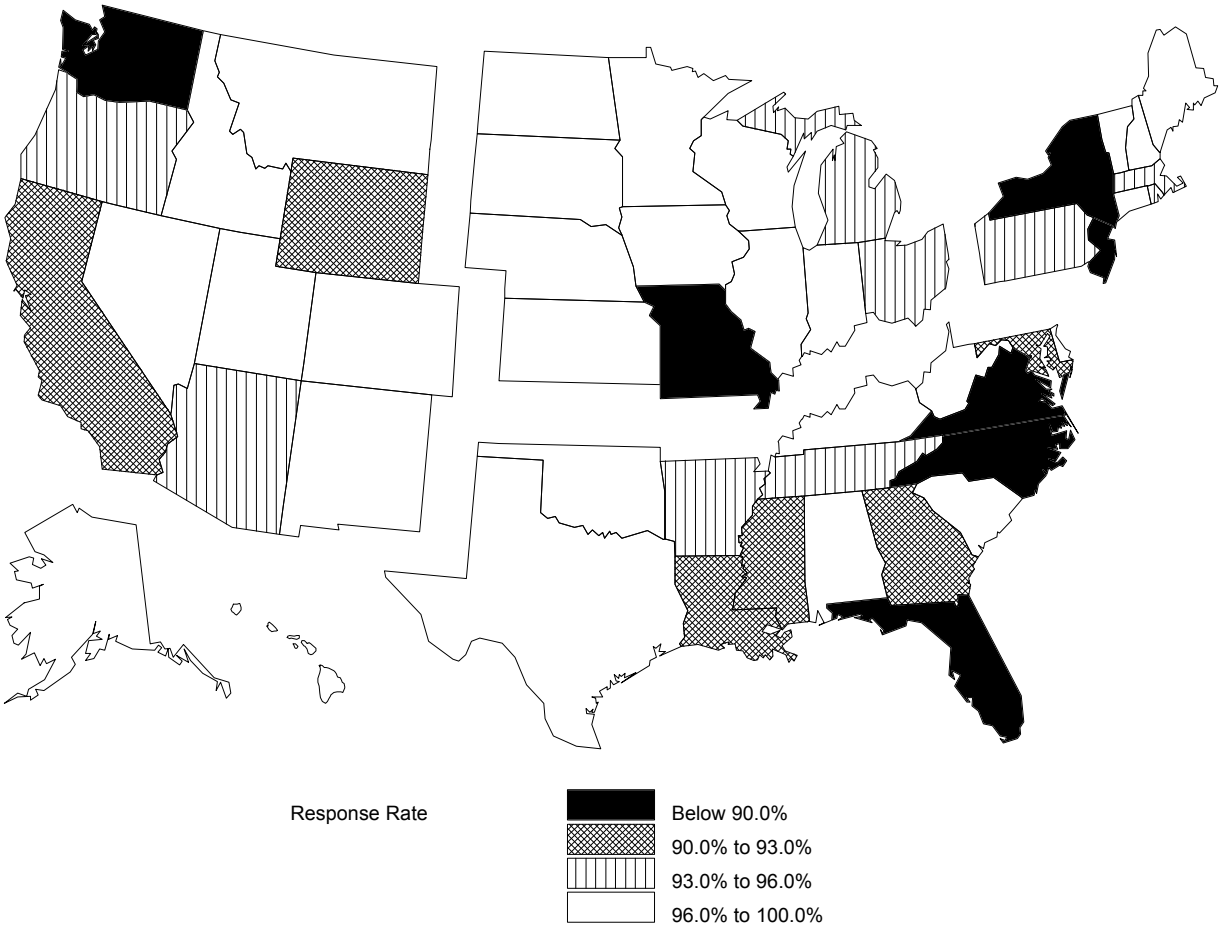
Notice that there are large regional differences in response rates for central cities (where the range is over 9 percent), somewhat smaller differences for the urban fringe/large town schools by region (where the range is a little over half as great, at five percent), and only slight differences by region for rural/small town schools (with a range of only one percent).

Administrators from rural/small schools had the highest response rate in three out of the four regions. Put another way, as was seen earlier, for the public school component of SASS (Section 3.2), rural schools everywhere were uniformly good responders. In the Midwest, for all types of areas, response rates were good. In the South and West, while they were good in rural areas, they were somewhat below average in the central cities and urban fringe/large town schools. In the Northeast, the response rates were the poorest in all three types of areas[82].

On the pages follow, response rates are examined further by urbanicity. These state and region maps provide a deeper understanding of the patterns seen in table 3.4.2 Figures 3.4.2 to 3.4.4 show the state response rates separately for central cities (figure 3.4.2). urban fringe/large towns (figure 3.4.3) and rural/small towns (figure 3.4.4) respectively.

[82] For the Northeast the difference between rural/small town and urban fringe/large town administrators was significant.

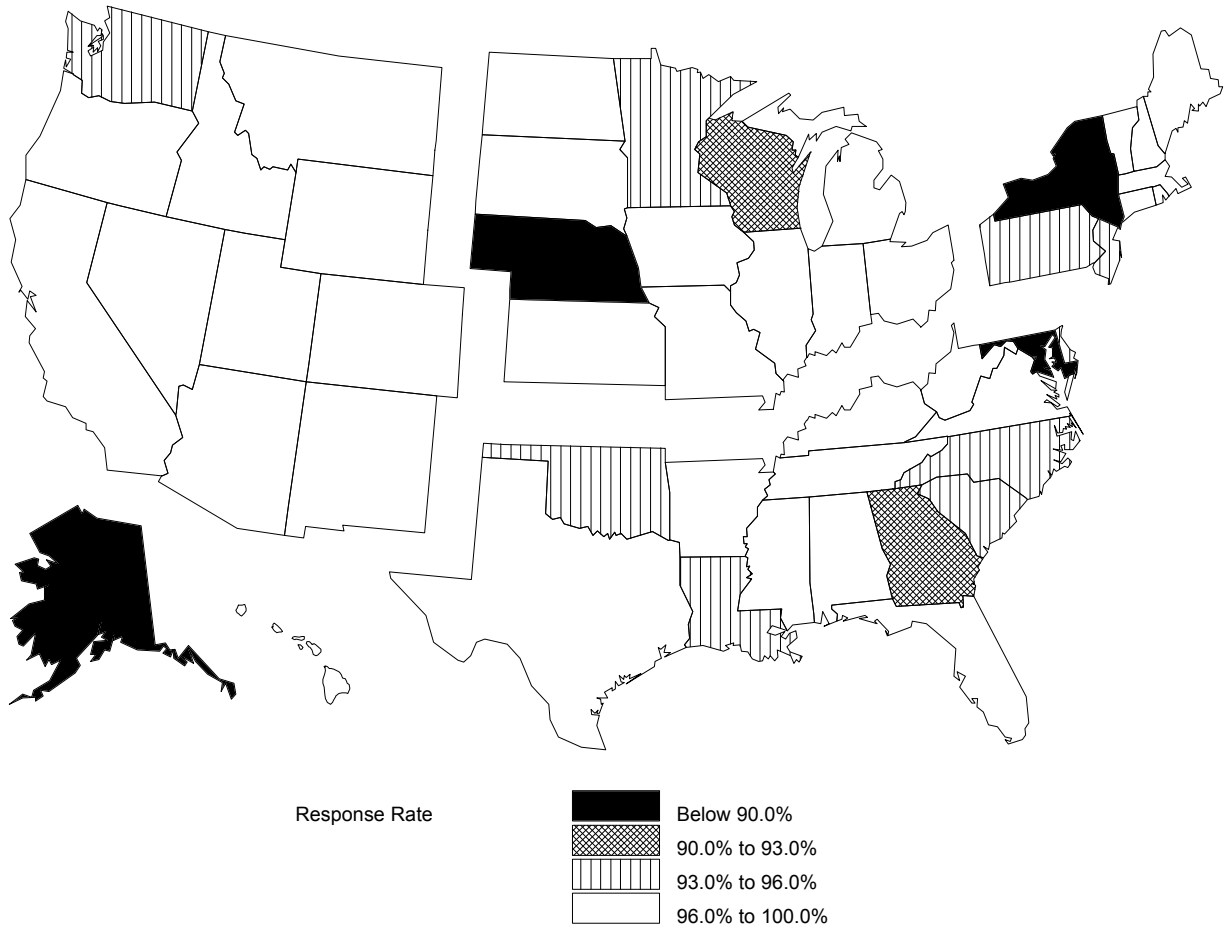
Figure 3.4.2 -- Central city weighted response rates: Schools and Staffing Survey 1990-91, Public School Administrator Component.



NOTE: The District of Columbia, at 88.88 percent, has not been shown separately.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Administrator Questionnaires).

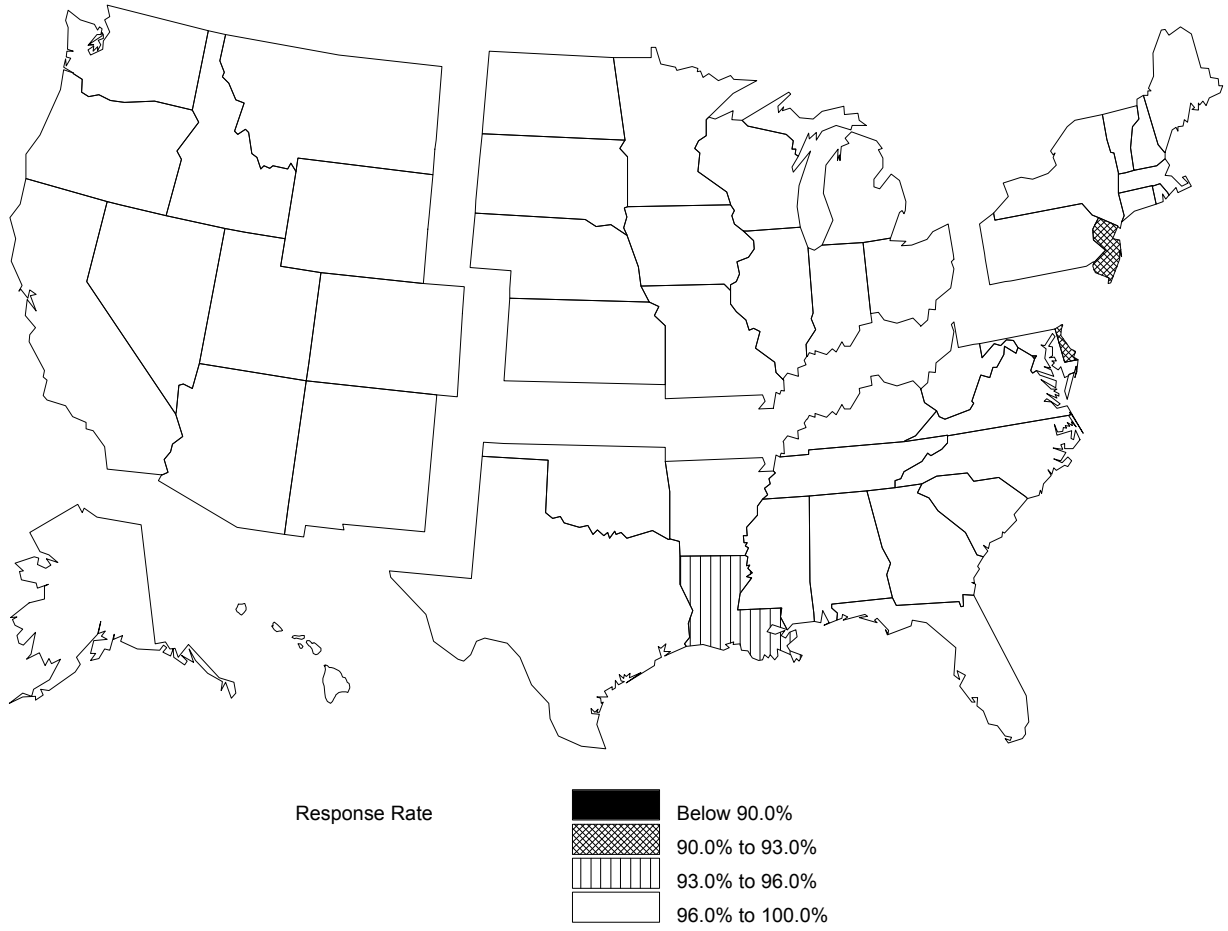
Figure 3.4.3 -- Urban fringe/large town weighted response rates: Schools and Staffing Survey 1990-91, Public School Administrator Component.



NOTE: The District of Columbia does not have any urban fringe/large town school administrators.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Administrator Questionnaires).

Figure 3.4.4 -- Rural/small town weighted response rates: Schools and Staffing Survey 1990-91, Public School Administrator Component.



NOTE: The District of Columbia does not have any rural/small town school administrators.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Administrator Questionnaires).

School Level and School Size --As can be seen in table 3.4.3, the school level administrator response rates were virtually all over 94 percent with the exception of combined schools for the Northeast (at about 91 percent).

Table 3.4.3 -- Weighted response rates by school level and region: Schools and Staffing Survey 1990-91, Public School Administrator Component.

(In Percent)

Census Region	Elementary	Secondary	Combined
Midwest	98.39	99.14	98.90
Northeast	93.91	95.98	90.91
South	96.20	96.58	95.81
West	96.25	97.62	96.90

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Administrator Questionnaires).

The Northeast continues to show the greatest range in school level administrator response rates at just over five percentage points, while the Midwest, South, and West ranges were well under two percentage points.[83] In all regions, secondary school administrators consistently displayed higher response rates as compared to either elementary or combined school administrators. The low response rates were divided evenly between elementary and combined school administrators.

[83] These differences are statistically significant for the Northeast; but not for the other regions.

As for school size and region (see table 3.4.4 below), the response rates were all above 90.00 percent with the exception of schools with 750 or more students from the Northeast (89.42 percent).

Table 3.4.4 -- Weighted response rates by school size and region: Schools and Staffing Survey 1990-91, Public School Administrator Component.

(In Percent)

Census Region	1 to 149	150 to 499	500 to 749	750 or More
Midwest	96.51	98.86	99.81	98.56
Northeast	97.63	95.32	94.60	89.42
South	95.80	96.81	95.45	96.28
West	98.21	96.43	97.50	94.35

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Administrator Questionnaires).

The Northeast again showed the greatest range in school size response rates at just over six percentage points, while the response rate range was less than three percentage points in each of the other three regions.[84] The pattern, though, is mixed. Only in two regions, the Northeast and West, do the smallest schools, those with 1 to 149 students, have the highest response rates. The overall highest rate by school size was from the Midwest (at 99.81 percent), for administrators from schools with 500 to 749 students. Response rates from the other three regions were all within about three percentage point of the overall mean, except for Northeast school administrators in schools with 750 or more students (where, as was already mentioned the response rate was 89.42 percent).

Response Rates at the State Level. --Large variations may be found across individual states. Some states have high, uniform response rates for all categories. Two states, Idaho and Indiana, had 100 percent response rates for all urbanicity, school level, and school size categories. Conversely, the response rates for the District of Columbia and New Jersey fell below those of the U.S. Total for all categories. Maryland also consistently showed one of the lowest response rates at each school level and school size. Of course, most states are intermediate -- not easily described by any one simple pattern.

Large variations in response rates were found between individual states. Major variations were also found among the three different classifications for the individual States. Basic table B.8 in Appendix B shows, for example, a range greater than 10 percentage points for response rates by urbanicity within eight states: Alaska, Florida, Maryland, Missouri, Nebraska, New York, North Carolina, and Virginia.

[84] Differences by region are significant and also by size of school, but there is not a significant difference in the school size effects within regions.

3.5 SASS Private School Administrator Component

The overall weighted response rate for the 1990-91 SASS Private School Administrator Component was 90.05 percent. The response rates for urbanicity showed a range[85] of six percentage points; urban fringe/large town schools had the highest response rate at 93.47 percent, while rural/small town schools showed the lowest at 86.29 percent. Schools in central cities had an intermediate response rate, at 90.31 percent.

The range of response rates by school level was quite large and possibly important, at 10 percentage points. Secondary schools had the highest response rate (at 93.89 percent), while combined schools showed the lowest (83.89 percent) with elementary schools being close in rate to secondary schools (at 92.86 percent).[86]

School size showed a response rate range of about eight percentage points. School administrators with 1 to 149 students had the lowest response rate (at 85.98 percent). The response rates then rose to the 92 to 94 percent range -- first to 94.02 percent for schools with 150 to 499 students, then falling slightly to 92.13 percent for administrators in schools with 500 to 749 students. School administrators with 750 or more students had a response rates at 93.28 percent.[87]

Overall response rates by region varied by roughly six percentage points. The Midwest region had the highest response at 92.41 percent while the South had the lowest at 85.71 percent. The Northeast and the West regions had almost identical response rates with 91.06 percent and 91.01 percent respectively.[88]

[85] This range not significant statistically.
[86] The difference in national response rates by school level is statistically significant.
[87] This difference is significant and may have operational significance for SASS -- a point to be brought out in the recommendations made in the concluding chapter of this report.
[88] The response rate for the Midwest region is statistically significantly different from the response rates for the Northeast and South regions.

Urbanicity. -- The urbanicity response rates by region were all above 84.00 percent with the exception of rural schools in the South (81.46 percent). Table 3.5.1 below summarizes these regional differences.

Table 3.5.1 -- Weighted response rates by urbanicity and region: Schools and Staffing Survey 1990-91, Private School Administrator Component.

(In Percent)

Census Region	Central City	Urban Fringe/ Large Towns	Rural/ Small Towns
Midwest	91.58	98.04	89.26
Northeast	89.06	93.79	89.26
South	86.94	89.22	81.46
West	94.39	92.26	84.97

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private Administrator Questionnaires).

Notice that there are large differences in response rates for urban fringe/large town administrators by region (where the range is about 9 percent), somewhat smaller differences for rural/small town school administrators (where the regional range is about 8 percent), and sizable but smaller differences by region for central city administrators (with a range of 7 percentage points). In the South, for all types of areas, response rates were the lowest. In the other regions, there was no clear overall winner. The Midwest had the best urban fringe/large town response rate (at 98.04 percent), the Northeast had the best rate of response among administrators in rural/small towns (at 89.67 percent) with the West having the best response rates for central city school administrators (94.39 percent).[89]

[89] There are no statistically significant differences across urbanicity by region. The only statistically significant difference in response rates is between Midwest and Northeast urban school administrators.

School Level and School Size. --As can be seen in table 3.5.2, the school level response rates were almost all at or above 90.00 percent with the exception of combined schools, where they ranged from a low of 79.94 percent to a high of 86.54 percent.

Table 3.5.2 -- Weighted response rates by school level and region: Schools and Staffing Survey 1990-91, Private School Administrator Component.

(In Percent)

Census Region	Elementary	Secondary	Combined
Midwest	94.03	99.45	86.09
Northeast	93.62	91.31	85.32
South	89.79	91.80	79.94
West	93.45	91.77	86.54

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private Administrator Questionnaires).

The South and Midwest have very wide ranges in school level response rates at just under 12 and just over 13 percentage points; for the Northeast and West the administrator response rates range a good bit less but still sizable at about eight percentage points.[90] In the Northeast and West regions, elementary schools had the highest response rate; in the South and Midwest, secondary school administrators had the best response rates. In all regions combined schools were the lowest.

[90] These ranges are significant.

As for region and school size (see table 3.5.3 below), the response rates were all above 87.00 percent -- with the exception of schools with 750 or more students from the Northeast (82.49 percent) and small schools with 1 to 149 students in the South (where the response rate among administrators was only 80.14 percent.

Table 3.5.3 -- Weighted response rate by school size and region: Schools and Staffing Survey 1990-91, Private School Administrator Component.

(In Percent)

Census Region	1 to 149	150 to 499	500 to 749	750 or More
Midwest	88.69	95.92	98.62	100.00
Northeast	88.42	93.73	88.10	82.49
South	80.14	90.63	91.17	93.63
West	87.04	96.11	93.32	100.00

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private Administrator Questionnaires).

The South showed the greatest range in school size response rates at almost 14 percentage points. The response rates ranged quite widely in the other regions too: from 13 percentage points in the West, to 11 points in the Midwest, to just under 8 points in the Northeast.[91] Smaller schools (with 1 to 149 students) tended to have lower response rates in every region, except the Northeast. Again, except for the Northeast, response rates tended to rise as the size of the school increased.

Response Rates at the association level. -- Across the nineteen sample strata by association (see table 3.5.4 below), fourteen had response rates above 90 percent, while only five had response rates below 90 percent. There was, however, considerable variation in response which fluctuated in a twenty-five percentage point range; Other Jewish schools showed the lowest response rate (72.39 percent) and the Evangelical Lutheran Church of America the highest (98.85 percent).

[91] Differences by school size across regions are significant and also by size of school, but there is not a significant difference in the school size effects within regions.

Table 3.5.4 -- Weighted strata response rates: Schools and Staffing Survey 1990-91, Private School Administrator Component.

(In Percent)

Association	Response Rate
Evangelical Lutheran Church in America	98.85
Solomon Schechter Day Schools	97.87
Evangelical Lutheran Church - Wisconsin Synod	97.51
Evangelical Lutheran Church - Missouri Synod	97.34
Other Lutheran	97.30
National Catholic Education Association, Jesuit Secondary Education Association	96.24
Association of Military Colleges and Schools	95.45
General Council of Seventh-Day Adventists	94.93
National Association of Private Schools for Exceptional Children	94.73
Christian Schools International	94.25
Friends Council on Education	93.75
National Association of Episcopal Schools	93.73
National Association of Independent Schools	93.65
American Montessori Society Schools	92.17
All Else	85.03
Area Frame	83.44
Hebrew Day Schools	83.06
American Association of Christian Schools International	73.38
Other Jewish	72.39

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private Administrator Questionnaires).

The Catholic, Solomon Schecter Day Schools, Lutheran-Missouri Synod and Evangelical Lutheran Church-Wisconsin Synod groups had response rates that were consistently above U.S. total rates for every level of all categories examined. The Other Jewish schools association group stood apart from the rest in having consistently response rates below U.S. total rates. This association also displayed the lowest response rate for 7 of the 10 categories, as well as the second lowest rate for the central city level in the urbanicity category and the 1-149 school size level. Other association groups which had response-rates below the US average were the National Society for Hebrew Day Schools, the American Association of Christian Schools and the "All Else" groups. The Episcopal, Seventh-Day Adventists, and National Association of Independent Schools groups also fell below U.S. average rates for some of the school size categories. For a more detailed look at association administrator response rates see basic table B.15 in Appendix B.

3.6 SASS Public School Teacher Component

The overall weighted response rate for the 1990-91 SASS Public School Teacher Component was 90.33 percent. Of the three survey categorical variables, urbanicity had the greatest impact on response rates. In fact, there was a range of six percentage points between the highest response rate for rural/small town teachers (93.32 percent) and the lowest response rate for central city teachers (87.25 percent).

School level showed little effect on the overall total weighted response rate in the Public School Teacher sample. There was less than one percentage point difference between the highest and lowest response rates. Elementary school teachers had a 90.59 percent rate; secondary school teachers had a 89.85 percent response rate; and teachers from combined schools had a response rate of 90.82 percent.

School size appeared to have a slight effect on response rates: the smaller the school size, the higher the response rate. The highest response rate was 92.34 percent for teachers with the smallest student enrollment (schools with 1 to 149 students). The rate fell steadily,[92] albeit slowly, as the school rose in size -- to 91.68 percent for schools with 150 to 499 students, to 90.15 percent for teachers in schools with 500 to 749 students, and to 88.79 percent for the largest schools (of 750 or more students).

The overall regional response rates for the Midwest (92.10 percent), South (91.74 percent), and West (90.37 percent) were slightly above the U.S. national average of 90.33 percent.[93] The Northeast region, however, had a significantly lower response rate; at 85.43 percent, it fell almost five percentage points below the national average. Figure 3.6.1 maps the overall response rate by state and Table 3.6.2 shows the states with the ten highest and ten lowest response rates.

[92] There were statistically significant differences by school size.
[93] There were statistically significant differences by census region.

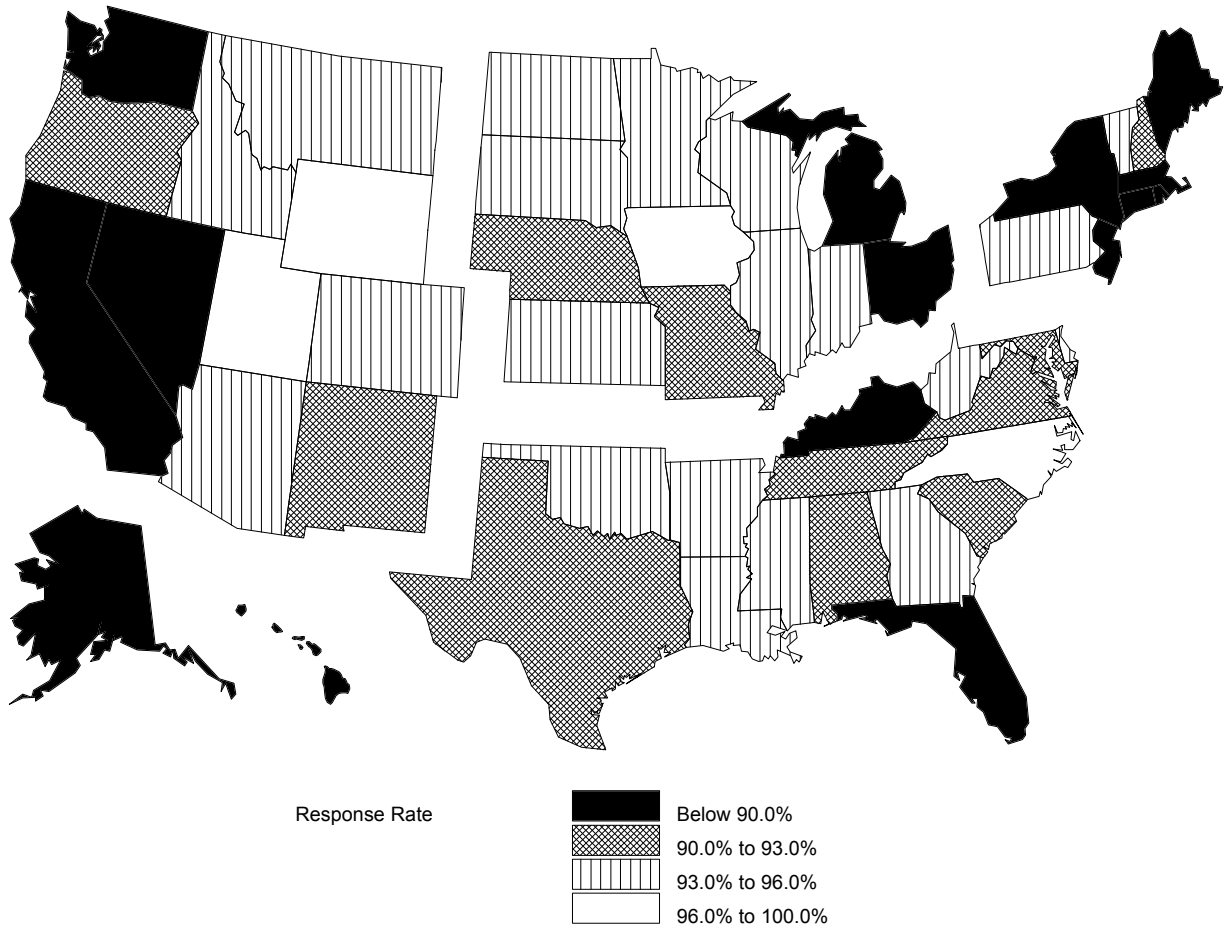
Table 3.6.1 -- Ten highest and lowest weighted response rates by state: Schools and Staffing Survey 1990-91, Public School Teacher Component.

(In Percent)

Highest			Lowest		
State	Response Rate	Region	State	Response Rate	Region
Utah	97.88	West	District of Columbia	69.40	South
Wyoming	96.81	West	New York	79.23	Northeast
Iowa	96.26	Midwest	Massachusetts	84.40	Northeast
North Carolina	96.01	South	Michigan	84.49	Midwest
North Dakota	95.79	Midwest	Connecticut	85.65	Northeast
Illinois	95.63	Midwest	New Jersey	86.32	Northeast
Delaware	95.63	South	Rhode Island	87.46	Northeast
Kansas	95.61	Midwest	Ohio	87.77	Midwest
Vermont	95.56	Northeast	California	87.88	West
Indiana	95.28	Midwest	Washington	88.11	West

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Teacher Questionnaires).

Figure 3.6.1 -- Overall weighted response rates: Schools and Staffing Survey 1990-91, Public School Teacher Component.



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NOTE: The District of Columbia, not shown above had an overall weighted teacher response rate of 69.40 percent.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Teacher Questionnaires).

Urbanicity. -- The urbanicity response rates by region were all at or above 84.00 percent, with the exception of central city schools for the Northeast (75.79 percent). Table 3.6.2 below summarizes these regional differences.

Table 3.6.2 -- Weighted response rates by urbanicity and region: Schools and Staffing Survey 1990-91, Public School Teacher Component.

(In Percent)

Census Region	Central City	Urban Fringe/ Large Towns	Rural/ Small Towns
Midwest	89.03	91.49	93.94
Northeast	75.79	84.29	92.94
South	90.07	90.34	93.59
West	90.03	89.58	91.63

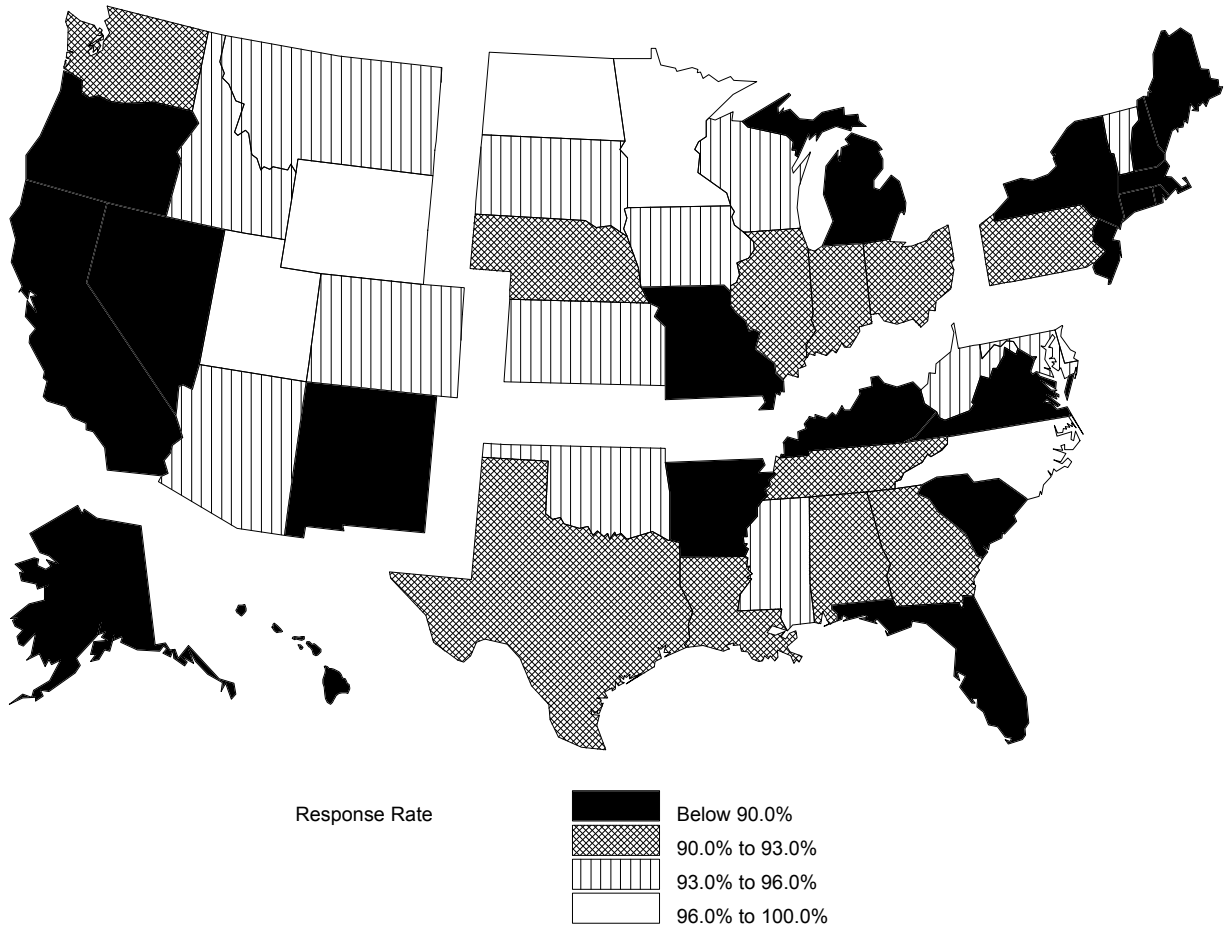
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Teacher Questionnaires).

Notice that there are large differences in response rates for central cities by region (where the range is about 12 percent), somewhat smaller differences for the urban fringe/large town schools by region (where the range is roughly half as great, at seven percent) , and only slight differences by region for rural/small town schools (with a range a third again as small, at about 2.5 percent). Put another way, for this component of SASS, rural schools everywhere were uniformly good responders. In the Midwest, for all types of areas, response rates were good. In the South and West, while they were good in rural areas, they were only intermediate in the central cities and urban fringe/large town schools. In the Northeast, the response rates were the poorest.[94]

On the pages which follow, response rates are examined further by urbanicity. These state and region maps provide a deeper understanding of the patterns seen in table 3.6.2. Figures 3.6.2 to 3.6.4 show the state response rates separately for central cities (figure 3.6.2), urban fringe/ large towns (figure 3.6.3) and rural/small towns (figure 3.6.4) respectively.

[94] Statistically significant differences exist for central city schools by region. The results are significance for urban fringe/large town schools. Significant differences exist among rural schools by region.

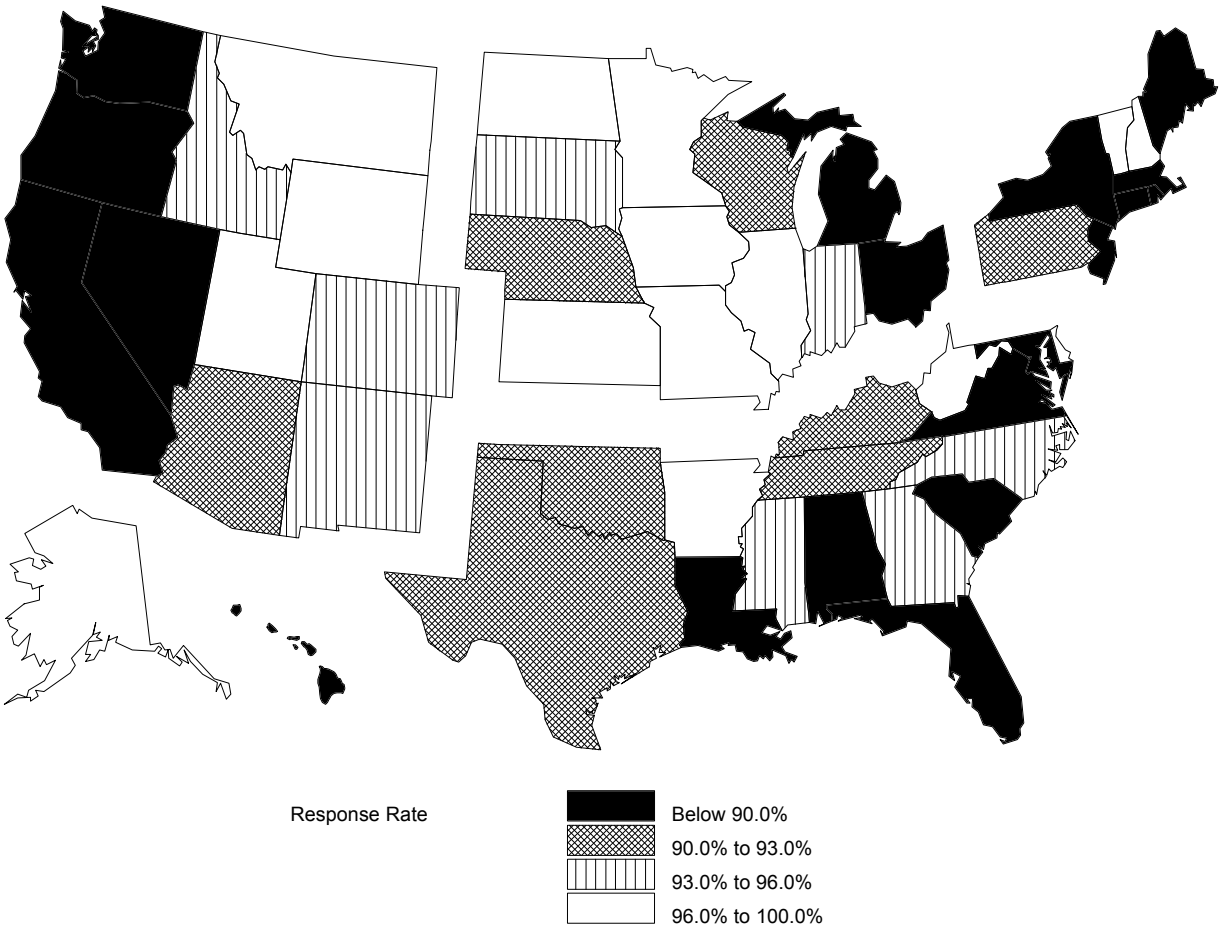
Figure 3.6.2 -- Central city weighted response rates: Schools and Staffing Survey 1990-91, Public School Teacher Component.



NOTE: The District of Columbia, not shown, has an overall weighted response rate of 69.40 percent.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Teacher Questionnaires).

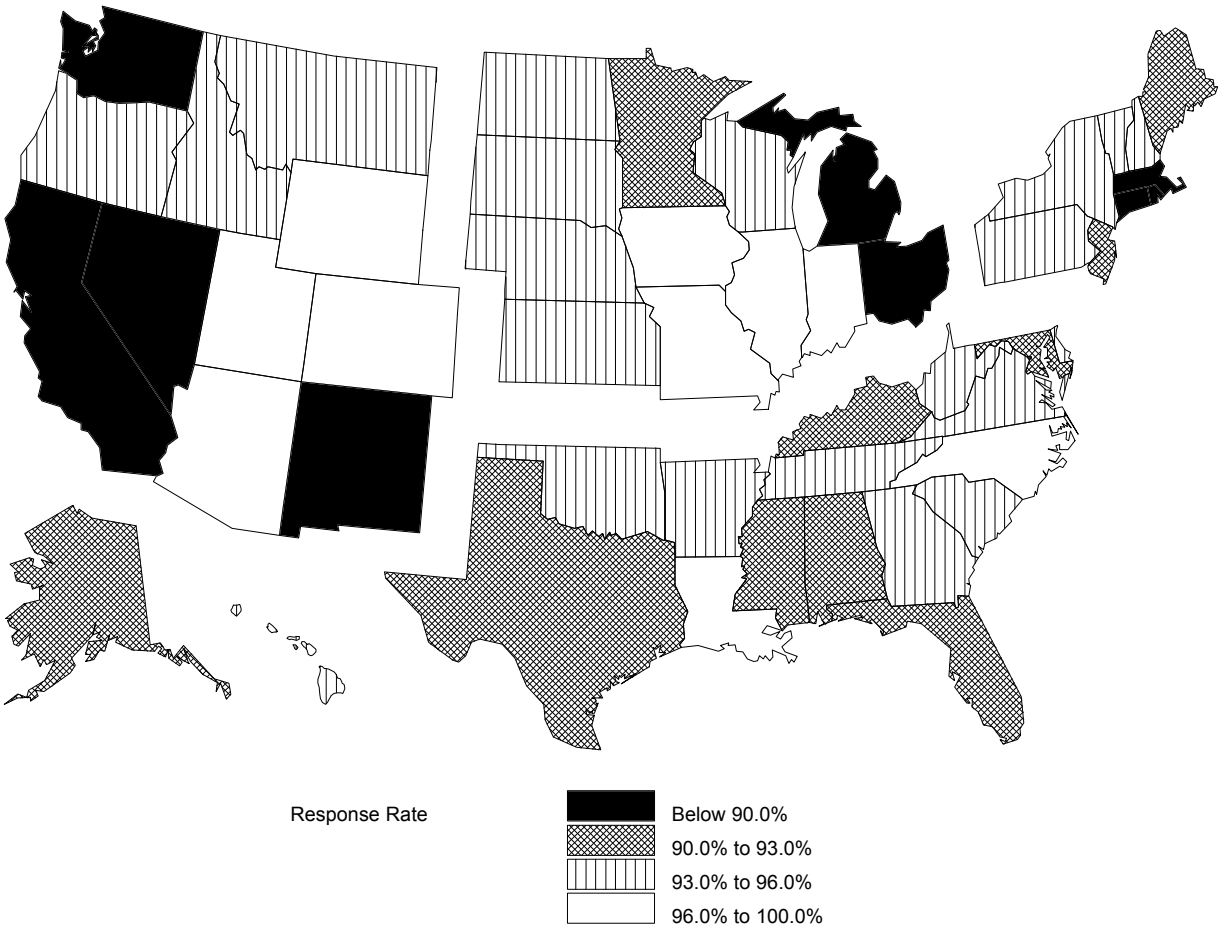
Figure 3.6.3 -- Urban fringe/large town weighted response rates: Schools and Staffing Survey 1990-91, Public School Teacher Component.



NOTE: The District of Columbia does not have any urban fringe/large town school teachers.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Teacher Questionnaires).

Figure 3.6.4 -- Rural/small town weighted response rates: Schools and Staffing Survey 1990-91, Public School Teacher Component.



NOTE: The District of Columbia does not have any rural/small town school teachers.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Teacher Questionnaires).

School Level and School Size. --As can be seen in table 3.6.3, the school level response rates were all above 90.00 percent with the exception of the Northeast region where they ranged from 85.15 to 89.71 percent.

Table 3.6.3 -- Weighted response rates by school level and region: Schools and Staffing Survey 1990-91, Public School Teacher Component.

(In Percent)

Census Region	Elementary	Secondary	Combined
Midwest	92.47	91.71	89.67
Northeast	85.35	85.15	89.71
South	92.17	90.98	91.57
West	90.45	90.19	91.33

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Teacher Questionnaires).

The Northeast again showed the greatest range in school level response rates --while the Midwest, South, and West ranges were less than three percentage points.[95] In the Midwest and South regions, elementary schools had the highest response rate; for the Northeast, combined schools had the highest.

As for region and school size (see table 3.6.4 below), the response rates were all above 89.00 percent -- again with the exception of Northeast schools.

Table 3.6.4 -- Weighted response rates by school size and region: Schools and Staffing Survey 1990-91, Public School Teacher Component.

(In Percent)

Census Region	1 to 149	150 to 499	500 to 749	750 or More
Midwest	92.99	92.98	91.04	91.24
Northeast	90.50	88.02	85.77	82.31
South	94.66	93.40	91.08	90.62
West	89.42	90.14	91.44	89.91

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public Teacher Questionnaires).

[95]The response rate range for the Midwest region is statistically significant.

Smaller schools tended to have higher response rates: schools with 1 to 149 students had the highest response rates for the Midwest and Northeast, while schools with 500 to 749 students had the highest response rate for the West. Large schools had lower response rates with schools with 750 or more students having the lowest response rates for the Northeast and South; and schools with 1-149 students having the lowest response rate for the West.[96]

Response Rates at the State level. --Large variations may be found across individual states. Table B.36 in appendix B can be explored to see these. Some states have high, uniform response rates for all categories. Vermont might be an example, here. Of course, most states were intermediate -- not easily described by any one simple pattern.

3.7 SASS Private School Teacher Component

The overall weighted response rate for the 1990-91 SASS Private School Teacher Component was 84.31 percent. The response rates for urbanicity showed a very narrow range of just one percentage point; rural/small town schools had the highest response rate at 84.57 percent, while urban fringe/large town schools showed the lowest at 84.11 percent. Schools in central cities had an intermediate response rate, at 84.36 percent -- all virtually identical.

The range of response rates by school level was larger and possibly important, at five percentage point.[97] Secondary schools had the highest response rate (at 87.12 percent), while combined schools, as usual, showed the lowest (82.03 percent) with elementary schools being in between (at 84.87 percent).

School size showed a response rate range of about nine percentage points. Teachers in schools with 1-149 students had the lowest response rate (at 78.46 percent). The response rates then rose first to 85.90 percent for teachers in schools with 150 to 499 students, then falling slightly to 84.30 percent for teachers in schools with 500 to 749 students. Teachers in schools with 750 or more students had a response rates at 87.31 percent.[98]

Overall response rates by region varied by roughly five percentage points. The Midwest region had the highest response at 86.90 percent while the West had the lowest at 81.90 percent. The Northeast and South regions had almost identical response rates with 83.51 percent and 83.99 percent respectively.[99]

[96] For the Midwest and West the differences by school size were not statistically significant. For the South and the Northeast, however, the differences by school size were significant.
[97] The differences by school level are significant.
[98] This difference between small schools (with 1 to 149 students) and schools with 150 to 499 and 750 or more students is statistically significant; furthermore, it may have operational significance too -- a point to be brought out in the recommendations made in the concluding chapter of this report.
[99] The Northeast region is statistically significantly different from the Midwest.

Urbanicity. -- The urbanicity response rates by region were all at or above 81.00 percent, with the exception of teachers from schools in the West region -- where in two cases the rates were somewhat smaller (77.37 percent for teachers in urban fringe/large towns in the West and 78.20 for rural/small town teachers from the West). Table 3.7.1 summarizes these regional differences.

Table 3.7.1 -- Weighted response rates by urbanicity and region: Schools and Staffing Survey 1990-91, Private School Teacher Component.

(In Percent)

Census Region	Central City	Urban Fringe/ Large Towns	Rural/ Small Towns
Midwest	83.86	90.40	88.94
Northeast	81.79	84.16	85.66
South	85.62	82.37	82.22
West	86.63	77.37	78.20

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private Teacher Questionnaires).

Notice that there are large differences in response rates for urban fringe/large town teachers by region (where the range is about 13 percentage points), somewhat smaller differences for rural/small town school teachers (where the regional range is about 10 percentage points), and still sizable but smaller differences by region for central city teachers (with a range of 5 percentage points).[100] The pattern by region is complex, such that there is no one region that is uniformly better or uniformly worse across all levels of urbanicity.

[100] These regional differences are significant.

School Level and School Size. --As can be seen in table 3.7.2, the school level response rates were almost all above 80.00 percent, with the exception of combined schools in the Midwest where the teacher response rate fell to 77.82 percent.

Table 3.7.2 -- Weighted response rates by school level and region: Schools and Staffing Survey 1990-91, Private School Teacher Component.

(In Percent)

Census Region	Elementary	Secondary	Combined
Midwest	88.85	91.95	77.82
Northeast	83.43	85.71	82.00
South	83.98	83.77	84.05
West	80.79	85.21	81.83

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private Teacher Questionnaires).

The Midwest was the only region with a wide range in teacher response rates.[101] At just over 14 percentage points, it had more than twice the spread of the region with the next largest range (about 5 percentage points in the West). Only in the South did elementary school teachers have the highest response rate (at 83.98 percent and even then just by a little, since secondary school teachers in that region had a response rate of 83.77 percent). Everywhere else secondary school teachers had the best response rates.

As for region and school size (see table 3.7.3 below), the response rates spanned a very wide range -- at almost 18 percentage points. The smaller schools (schools with 1 to 149

[101] This range was statistically significant.

students) were the ones where the teachers had the lowest response rates. By and large, teacher response rates increased as the size of their school increased. While a little uneven, this pattern held for each region.

Table 3.7.3 -- Weighted response rates by school size and region: Schools and Staffing Survey 1990-91, Private School Teacher Component.

(In Percent)

Census Region	1 to 149	150 to 499	500 to 749	750 or More
Midwest	80.52	87.89	90.58	91.82
Northeast	81.15	84.91	79.20	87.00
South	74.07	85.95	87.82	86.17
West	77.93	84.01	78.95	83.75

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private Teacher Questionnaires).

Within region, the South showed the greatest range in teacher response rates by school size (at about 12 percentage points). The response rates ranged fairly widely in the other regions too: from 11 percentage points in the Midwest, to 9 points in the Northeast, to just over 6 points in the West.[102]

Response Rates at the association level. --Across the nineteen association groupings or sample strata, sixteen had response rates below 90 percent, only three had response rates between 90 and 95 percent, and none had response rates above 95 percent. There was considerable variation in response rates (almost thirty-five percentage points) with the National Society of Hebrew Day Schools (60.05 percent) on the low end to Lutheran Church -Missouri Synod (94.83 percent) on the high end (see tables 3.7.4 and also table B.39 in appendix B).

[102] Differences by region are significant and also by size of school; further, there is a significant difference in the school size effects within regions for the Midwest and South.

Table 3.7.4 -- Weighted strata response rates: Schools and Staffing Survey 1990-91, Private School Teacher Component.

(In Percent)

Association	Response Rate
Lutheran Church - Missouri Synod	94.83
Evangelical Lutheran Church - Wisconsin Synod	92.06
Christian Schools International	90.10
Other Lutheran	89.46
Association of Military Colleges and Schools	88.40
National Catholic Education Association, Jesuit Secondary Education Association	88.39
Friends Council on Education	87.26
Evangelical Lutheran Church in America	86.53
National Association of Independent Schools	84.95
Solomon Schechter Day Schools	84.02
All Else	83.84
National Association of Episcopal Schools	83.82
General Council of Seventh-Day Adventist	81.70
American Montessori Society Schools	76.76
National Association of Private Schools for Exceptional Children	76.00
Area Frame	74.04
American Association of Christian Schools	69.92
Hebrew Day Schools	60.05
Other Jewish	57.12

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private Teacher Questionnaires).

3.8 SASS Local Education Agency Demand and Shortage Component

For the public school sector, the target population for the teacher demand and shortage (TDS) Component of SASS consisted of all U.S. public school districts.[103] These public school districts, often called local education agencies (LEAs), are governmental units administratively responsible for providing public elementary or secondary education (usually both). As set out in Chapter 2, LEAs associated with the schools selected as part of the public school survey (see Section 3.2) received a TDS questionnaire. An additional sample of LEAs not associated with the public school survey was also chosen such that the overall sample of LEAs was 5,424.

The overall weighted response rate for the 1990-91 teacher demand and shortage survey was 93.49 percent. The response rates by urbanicity showed a range[104] of just under three percentage points. Schools outside metropolitan areas or MSAs had the highest response rate at 94.37 percent, while central city schools showed the lowest, at 91.51 percent. Schools in MSAs, but outside central cities, had a response rate intermediate between the other two, at 92.43 percent.

The range of response rates by the number of schools in an LEA was quite small and probably unimportant, at less than a half of a percentage point. Smaller LEAs, with under 6 schools, had a higher response rate (at 93.60 percent) than LEAs with 5 or more schools (93.14 percent).[105]

LEA student enrollment showed a response rate range of just over six percentage points. LEAs with 300 to 599 students had the highest response rate (at 95.41 percent). The response rates for LEAs with smaller enrollments was only 91.61 percent. For LEAs with larger enrollments, there was also a decline, albeit unevenly to 89.12 percent for LEAs with 25,000 or more students.[106]

Response Rates by Region. --Overall response rates by region varied by roughly four percentage points. The South region had the highest response at 94.87 percent, while the Northeast had the lowest at 91.22 percent. The Midwest and the West regions had intermediate response rates of 94.11 and 93.12 percent respectively.[107]

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[103] As discussed in Chapter 2, there was also a private school counterpart to the public teacher demand and shortage (TDS) survey. These private school TDS questions were, however, included in other private school questionnaires and, hence, are not covered separately in this report. See Section 3.3 above for more on the SASS private school component.

[104] This range was large enough to be significant.

[105] Even with the large sample available this small difference in national response rates by size of LEA is not statistically significant

[106] The difference between the largest and smallest response rate is statistically significant, if the usual Bonferroni adjustments are made, as in Ahmed, S. (1992). op. cit. The lack of a clear pattern suggests that, in any case, the differences observed may have no operational significance -- a point to be brought out in the recommendations made in the concluding chapter of this report.

[107] The response rate for the Northeast region is statistically significantly different from the Midwest and the South.

As can be seen in table 3.8.1, the South region had four of the top ten highest responding States, including the highest two. On the other hand, out of the ten lowest responding states, the worst three were in the Northeast region; of the remainder three were in the South region, two in the Midwest, and two in the West region. Figure 3.8.1 shows the overall response rates for the 50 states and the District of Columbia.

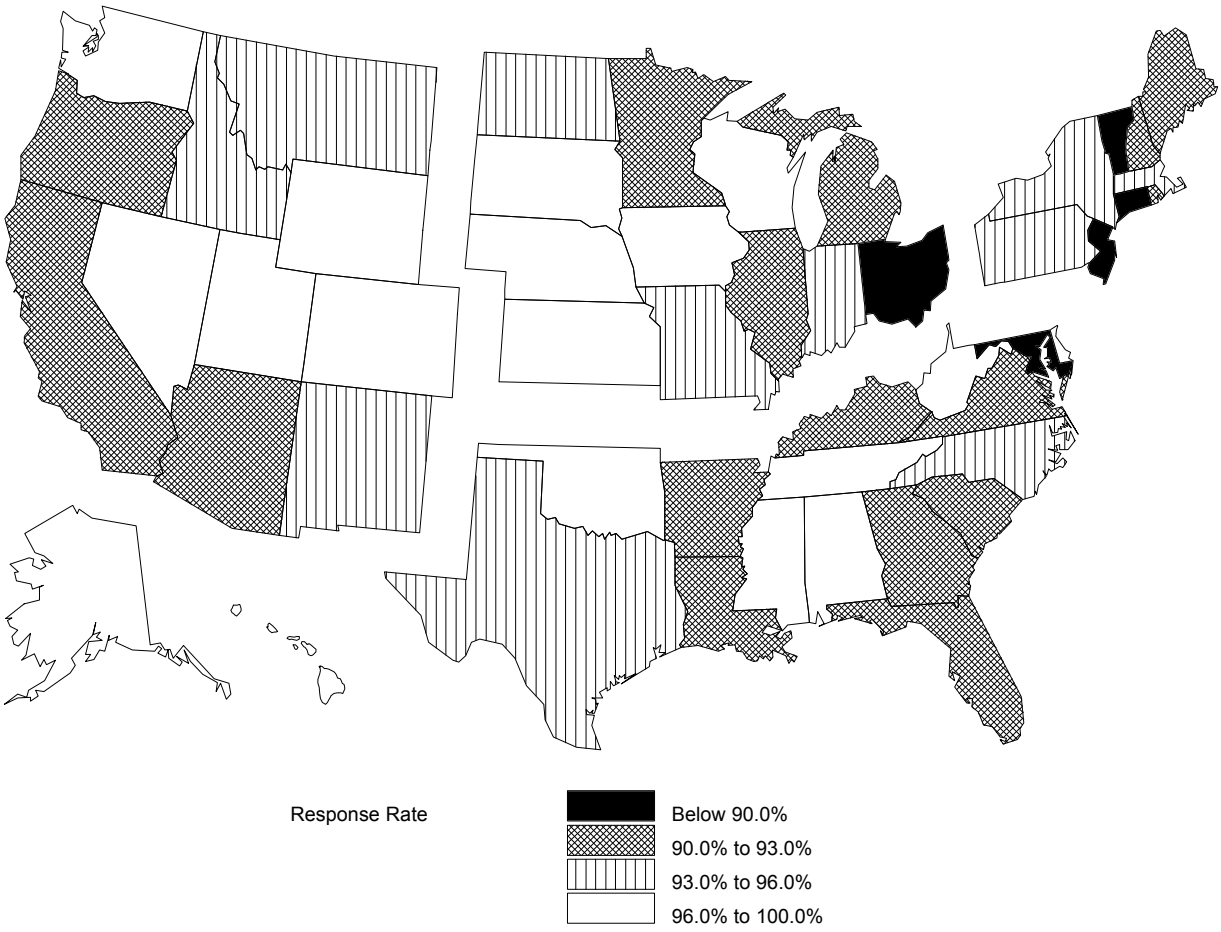
Table 3.8.1 -- Ten highest and lowest weighted response rates by state: Schools and Staffing Survey 1990-91, Public Teacher Demand and Shortage Component.

(In Percent)

Highest			Lowest		
State	Response Rate	Region	State	Response Rate	Region
Delaware	100.00	South	Connecticut	76.96	Northeast
District of Columbia	100.00	South	New Jersey	86.28	Northeast
Hawaii	100.00	West	Vermont	86.42	Northeast
Nevada	100.00	West	Maryland	87.55	South
Tennessee	100.00	South	Ohio	89.38	Midwest
Kansas	99.63	Midwest	Louisiana	90.10	South
Oklahoma	98.49	South	Michigan	90.17	Midwest
Iowa	98.38	Midwest	Arizona	90.40	West
Colorado	98.24	West	Virginia	90.68	South
South Dakota	98.18	Midwest	Oregon	91.23	West

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Teacher Demand and Shortage Questionnaire)

Figure 3.8.1 -- Overall weighted response rates: Schools and Staffing Survey 1990-91, Public Teacher Demand and Shortage Component.



NOTE: For the District of Columbia the response rate was 100.00 percent.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Teacher Demand and Shortage Questionnaire).

Urbanicity. -- The urbanicity response rates were all above 90.00 percent with the exception of LEAs in Central City MSAs for the Midwest (87.25 percent). The Midwest, also, showed the widest range of response rates at over eight percentage points.[108] For three of the four regions, LEAs outside of an MSA had the highest response rate, while LEAs in a central city had the lowest response rate for two out of the four regions . Table 3.8.2 below provides the details regionally.

Table 3.8.2 -- Weighted response rates by urbanicity and region: Schools and Staffing Survey 1990-91, Public Teacher Demand and Shortage Component.

(In Percent)

Census Region	Central City, MSA	MSA, Non-Central	Outside MSA
Midwest	87.25	91.31	95.82
Northeast	90.05	90.99	91.74
South	93.55	93.34	95.53
West	93.26	95.79	91.12

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Teacher Demand and Shortage Questionnaire)

On the pages which follow, response rates are examined further by urbanicity. These state and region maps provide more on the patterns seen in table 3.8.2. Figures 3.8.2 to 3.8.4 show the state response rates separately for MSA central cities (figure 3.8.2), noncentral city MSAs (figure 3.8.3) and areas outside MSAs (figure 3.8.4).

Table 3.8.3 -- Weighted response rates by number of LEA schools and region: Schools and Staffing Survey 1990-91, Public Teacher Demand and Shortage Component.

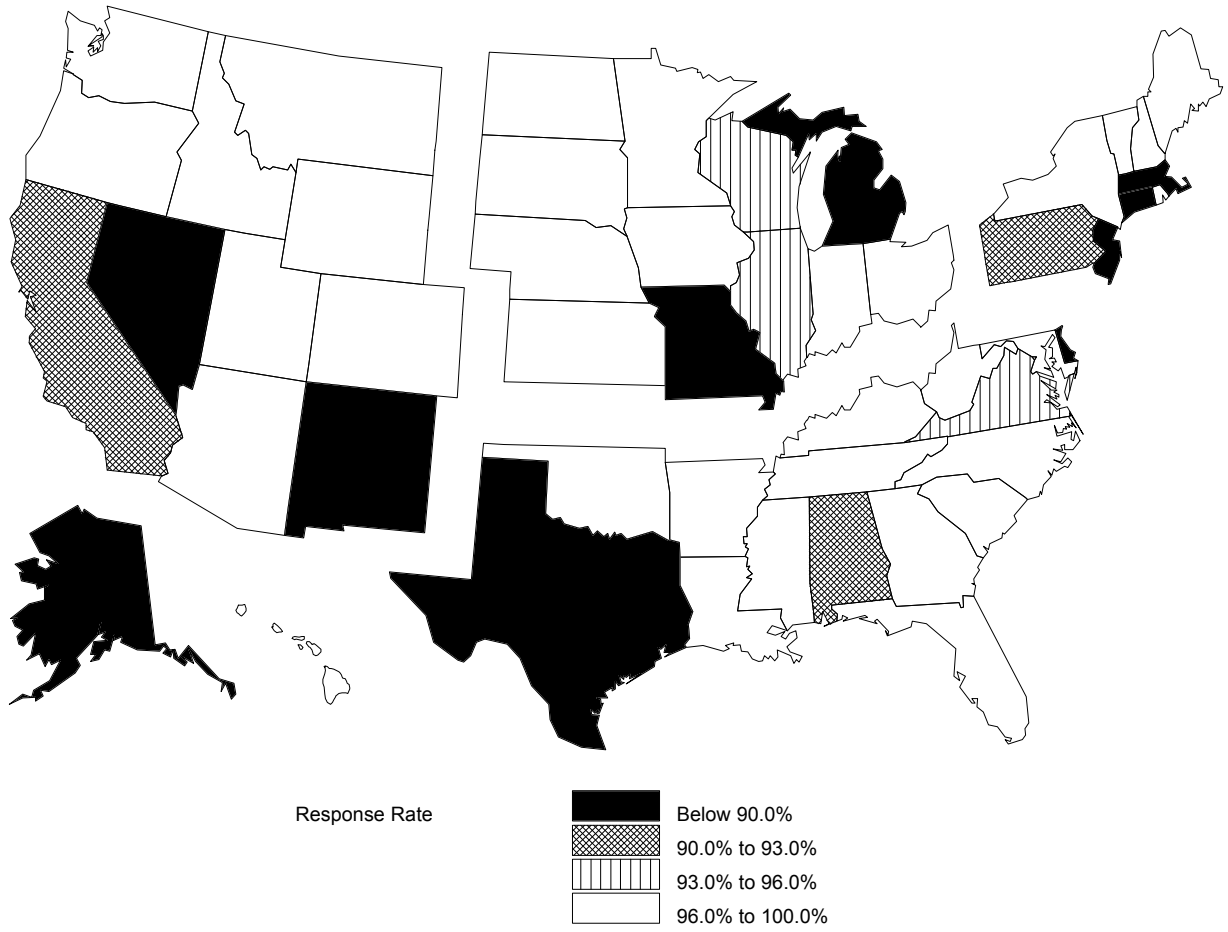
(In Percent)

Census Region	Under Six Schools	6 Schools and Over
Midwest	94.04	94.44
Northeast	91.16	91.39
South	95.49	93.71
West	93.35	92.23

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Teacher Demand and Shortage Questionnaire)

[108] This range was not statistically significant.

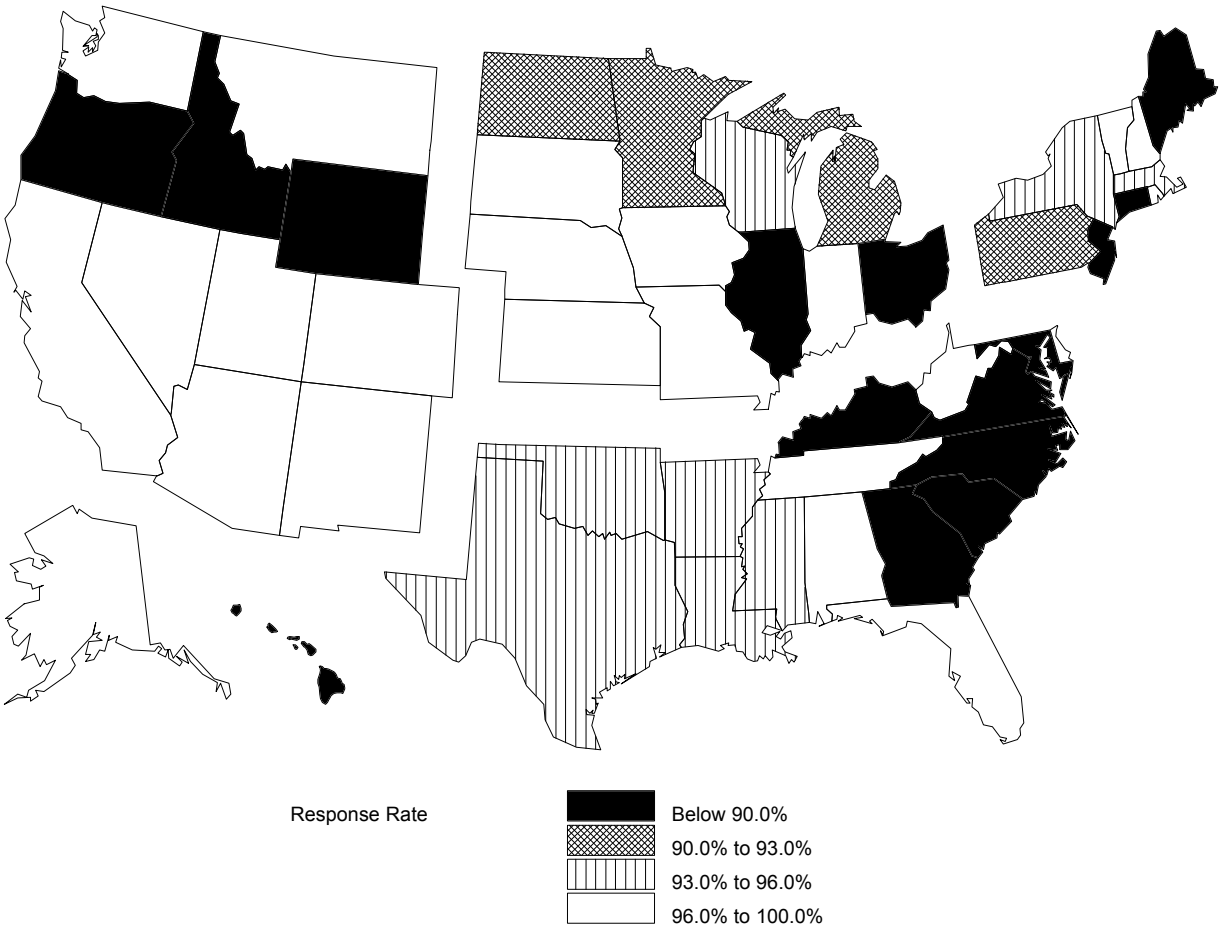
Figure 3.8.2 -- Central city of a metropolitan statistical area weighted response rates: Schools and Staffing Survey 1990-91, Public Teacher Demand and Shortage Component.



NOTE: For the District of Columbia, not shown, the response rate was 100.00 percent. Alaska, Delaware, and Nevada do not have any local education agencies which are in a central city of a metropolitan statistical area. These states are displayed as having a response rate below 90 percent.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Teacher Demand and Shortage Questionnaires).

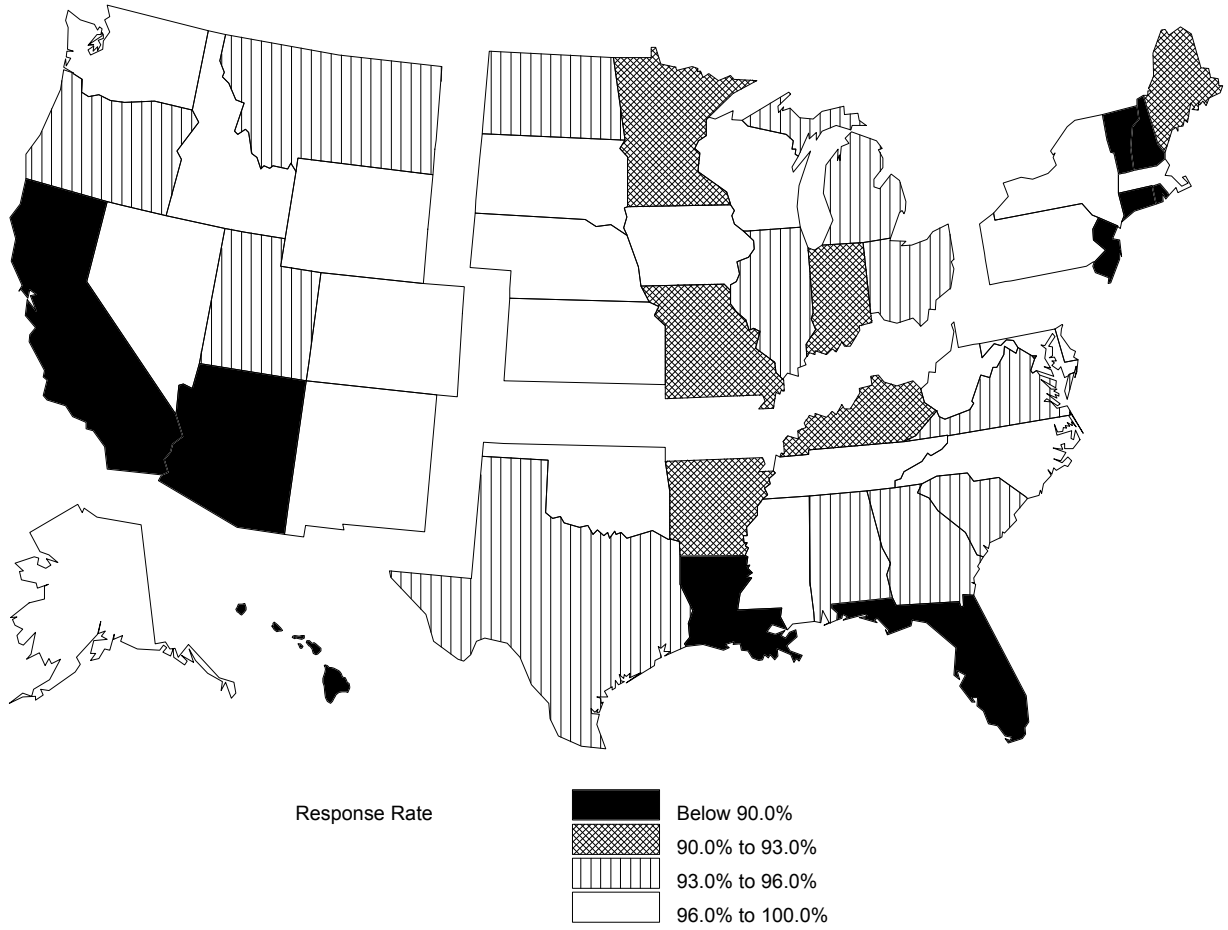
Figure 3.8.3 -- Not a central city of a metropolitan statistical area weighted response rates: Schools and Staffing Survey 1990-91, Public Teacher Demand and Shortage Component.



NOTE: The District of Columbia, Hawaii, and Wyoming do not have any local education agencies which are not in a central city of a metropolitan statistical area. These states are displayed as having a response rate below 90 percent.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Teacher Demand and Shortage Questionnaire).

Figure 3.8.4 -- Not a metropolitan statistical area weighted response rates: Schools and Staffing Survey 1990-91, Public Teacher Demand and Shortage Component.



NOTE: The District of Columbia, Hawaii, and New Jersey do not have any local education agencies which are not in a metropolitan statistical area. These states are displayed as having a response rate below 90 percent.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Teacher Demand and Shortage Questionnaire).

LEA number of schools and student enrollment. -As can be seen in table 3.8.3, response rates by the number of schools an LEA has varies only modestly by region. All the rates are above 91 percent, bunched in the range from 91.16 (Northeast, LEAs with less that 5 schools) to 95.49 percent (LEAs in the South with less than 5 schools).

The Northeast showed the lowest response rates for both types of LEAs at 91.16 percent for LEAs under 6 schools and 91.39 percent for LEAs with 6 schools or more. The West had intermediate response rates, while the South had the highest rates for small LEAs (at 95.49 percent) and the Midwest had the highest response rates for the larger LEAs (at 94.44 percent).

Table 3.8.4 -- Weighted response rates by number of LEA students and region: Schools and Staffing Survey 1990-91, Public Teacher Demand and Shortage Component.

(In Percent)

Census Region	Under 300	300 to 599	600 to 999	1,000 to 2,499	2,500 to 4,999	5,000 to 9,999	10,000 to 24,999	25,000 Plus
Midwest	90.15	97.53	95.55	93.84	96.83	96.22	93.52	91.67
Northeast	84.38	94.83	92.03	91.75	93.58	90.58	87.09	75.00
South	94.09	96.25	93.30	97.85	93.86	93.44	94.28	88.00
West	94.90	90.22	90.37	97.14	88.64	86.65	94.41	92.97

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Teacher Demand and Shortage Questionnaire)

No pattern appears to stand out in table 3.8.4 that has not been commented on already. The LEAs with 300 to 599 students all have among the best response rates by region. While generally smaller rates occur as the LEAs become larger, this is uneven. Regionally, the response rates calculated by the number of students in the LEA had the greatest range at over twenty-two percent. At the low end of the response rates were LEAs in the Northeast with 25,000 or more students (75.00 percent), while LEAs in the South with 1,000 to 2,499 students (97.85 percent) had highest response rates.

Response Rates at the State level. --Large variations may be found across individual states. Table B.1 in Appendix B can be explored to see these variations. Some states have high, uniform response rates for all categories. Iowa might be an example, here. Most states show a wide range of response rates across categories -- not easily described by any one simple pattern.

3.9 Overall Summary of SASS Descriptive Analyses

So far in the present Chapter, descriptive detail has been provided on the weighted response patterns of each of the seven major components of the 1990-91 SASS. In this concluding Section, an attempt will be made to summarize what has been learned and to anticipate the inferential modeling analyses that are to come next, in Chapter 4. The particular questions to be addressed include --

- Are there any overall response patterns that go across SASS components?
- What about big response differences among the SASS components?
- Between public and private, for example?
- Common response relationships for the same variables in different components? (By urbanicity, for example?)
- Commonalities by geographic areas? (Regions? States? Associations?)
- Procedural or analysis recommendations that can be made at this point?

Very broadly, the seven components seem to group into three categories: the teacher demand and supply (TDS) survey (which is in a class by itself), the three remaining public sector surveys (of schools, administrators, and teachers), and the three private sector surveys (again of schools, administrators, and teachers).

Teacher Demand and Shortage (TDS) Survey.-- To begin the discussion, it might be appropriate to start with the TDS survey and why it differs from the rest. The most obvious TDS difference is that the TDS variables are defined unlike those in the other components of SASS. This alone is enough to keep the TDS separate.

The unit of analysis, LEAs, is also much larger than for the other components. The size of the LEA unit probably contributes to the fact that the TDS variables, nationally at least, do not seem to predict response rates very well. Indeed, nationally there are only very small response rate differences by urbanicity and LEA size. Even for number of students, LEA response rates do not vary more than an average of a half of a percent per class. True, there are some big differences by state and even a few regionally; but these are virtually all within sampling error.

Overall Public and Private Sector Results (Excluding TDS).- Unlike the TDS survey, statistically significant differences exist across at least some of the frame variables in both the three private sector surveys and among the remaining three public sector ones. To talk about these six components further it might be of value to divide them up, as shown below, into surveys with the teacher as the respondent and those surveys either for administrators or of a more general nature. In any event, the resulting table (Table 3.9.1) makes clear two big differences in rates: first between public and private (of about 6 percent), and then between teacher and nonteacher surveys (of about 5 percent). Not shown, but also important for private schools is the

difference between the general school survey (at 84.95 percent) and the corresponding private administrator survey (at 90.05 percent).[109]

Table 3.9.1 -- Average weighted response rates for SASS public and private sector components, teacher versus nonteacher: Schools and Staffing Survey 1990-91.

(In Percent)

Sector	Teacher	Nonteacher
Public	95.33	90.33
Private	89.00	84.31

NOTE: These teacher response rates exclude the school portion of nonresponse, focusing solely on the degree to which teachers themselves failed to respond. The overall response rates for the nonteacher components of SASS are simple averages of the weighted response rates from sections 3.2 to 3.5, the public and private school and administrator surveys.

SOURCE: Weighted overall response rates shown here for the teacher components of SASS were taken directly, without change from Sections 3.6 (Public) and 3.7 (Private).

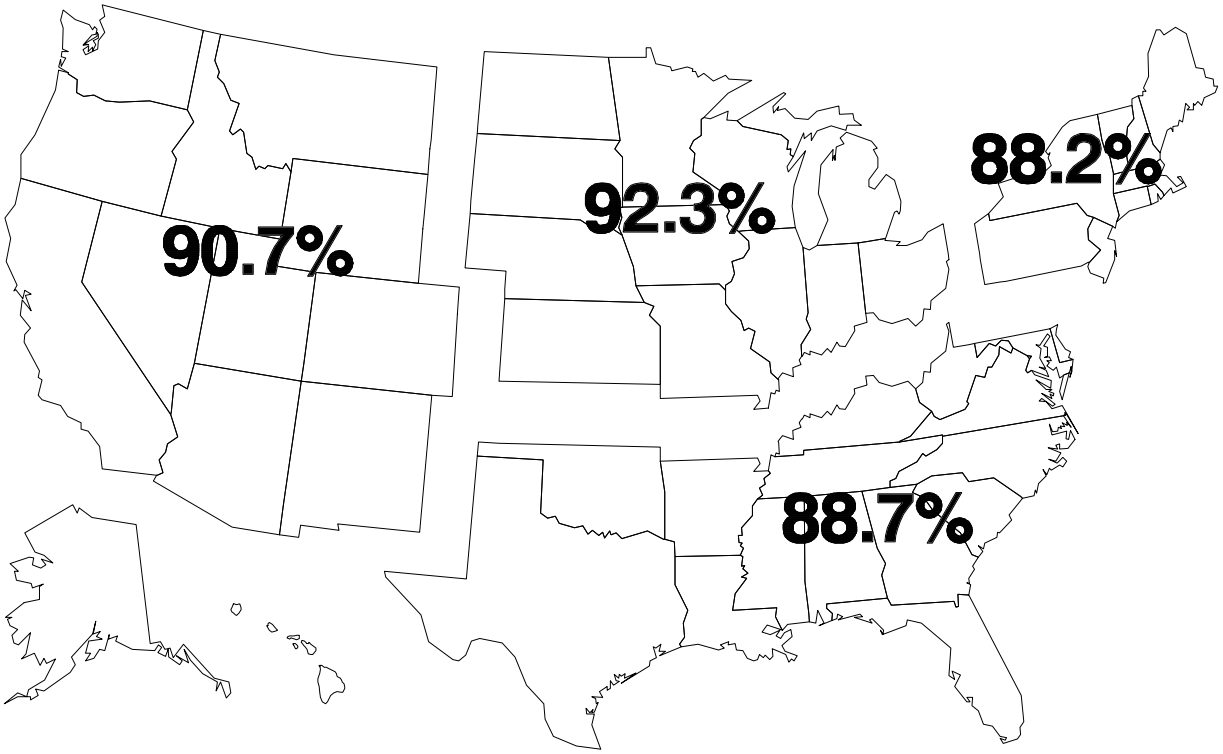
Regional Differences and Similarities (Excluding TDS).- Regional patterns might be a good place to look next. At the Census region level, for example, some broad statements seemingly are possible. The overall map by region, shown as figure 3.9.1, indicates that, at least for the median response rates[110] of all the six components (excluding TDS), the Midwest was the best, followed by the West, then the South, and finally the Northeast. Notice, too, that these rates are not too far apart -- with a range of four percentage points separating them.[111]

[109] For public schools, the comparable values were 95.30 percent for the general public school survey and 96.68 percent for the public administrator survey.

[110] To obtain these medians the weighted overall response rates from the six SASS components studied in this Chapter (excluding TDS) were ordered and the middle two averaged; this was done separately by region.

[111] This range is significant. Notice to that these rates have a range of four percentage points separating them.

Figure 3.9.1 -- Median weighted response rates across SASS components by region: Schools and Staffing Survey 1990-91.



NOTE: To obtain these medians the weighted overall response rates from the six SASS components studied in this Chapter (excluding TDS) were ordered and the middle two values averaged; this was done separately by region.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (All Questionnaires).

The Midwest has the best overall response rate for both public and private sector schools. For the other three regions, the ranking by response rate differs mainly by whether the survey was private or public, as is shown below.

Table 3.9.2 -- Median ranking of regional weighted response rates, by private and public sector SASS components separately, TDS excluded: Schools and Staffing Survey 1990-91.

Ranking	Public	Private
1	Midwest	Midwest
2	South	Northeast
3	West	West
4	Northeast	South

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (All Questionnaires except Teacher Demand and Shortage).

The switch in rankings of the South and Northeast, between private and public, is hard to explain completely. Among the factors, though, are the low response rates of central city public schools in the Northeast versus otherwise similar private schools; and, in the rural South, the prevalence of small private schools with low response rates.

Urbanicity Differences and Similarities. -- Again, excluding the TDS survey, average response rates vary considerably by urbanicity between private and public sector schools. Table 3.9.3 summarizes these. In particular, note that for the public sector SASS components, it is the rural/small town schools that are the best responders and the central city schools the worst. For private sector schools, it is the urban fringe/large town schools which are the best responders with rural and central city schools about the same .

Table 3.9.3 -- Median weighted response rates by urbanicity, public and private sector separately, excluding TDS: Schools and Staffing Survey 1990-91.

(In Percent)

Urbanicity	Public	Private
Central City	92.59	84.36
Urban fringe/large town	93.52	87.41
Rural/small town	97.51	84.56

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (All Questionnaires except Teacher Demand and Shortage).

School Level Differences and Similarities. -- Again, excluding the TDS survey, average weighted response rates vary considerably by school level for private and public sector schools.

Table 3.9.4 summarizes these. For the public sector schools, the response rates are extremely close for all school levels; not so for private sector schools, where combined schools have a much lower response rate than the other school levels; indeed, the combined school response rate was 82.03 percent, about twice as far away from their public sector counterparts (at 94.12 percent) as was true of elementary or secondary school response rates (averaging 95.41 percent for the public sector versus 88.69 percent for private schools).

Table 3.9.4 -- Median weighted response rates by school level, public and private sector separately, excluding TDS: Schools and Staffing Survey 1990-91.

(In Percent)

School Level	Public	Private
Elementary	95.31	87.63
Secondary	95.51	89.75
Combined	94.12	82.03

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (All Questionnaires except Teacher Demand and Shortage).

School Size Differences and Similarities. --Again, excluding the TDS survey, average response rates vary considerably by school size for private and public sector schools. Table 3.9.5 summarizes these. Notice the regular pattern of decreasing response rates by school size for public sector schools; conversely, while the smallest schools have the lowest response rate, there is no real pattern of response rates by size for private sector schools.

Table 3.9.5 -- Median weighted response rates by school size, public and private sector separately, excluding TDS: Schools and Staffing Survey 1990-91.

(In Percent)

Enrollment	Public	Private
1 to 149	96.79	80.99
150 to 499	95.79	87.65
500 to 749	94.90	84.30
750 or More	92.96	87.31

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (All Questionnaires except Teacher Demand and Shortage).

State and Association Differences and Similarities-- There are fairly big differences by state across the public sector surveys. These can be seen in table 3.9.6 below. Smaller differences exist across the private sector components by Association (as shown in table 3.9.7).

To examine state/association differences in detail is beyond the scope of the present chapter; but will be addressed in part[112] by Chapter 4, which attempts through modeling to organize in another way the complexities of response by all the factors being examined: urbanicity, school level, school size, and state/association.

Some Concluding Remarks-- In Chapter 2, there were recommendations for consideration of changing the way certain parts of SASS are conducted. The goal there was to suggest techniques to reduce nonresponse or at least its impact. It seems appropriate to do something similar here, building remarks mainly on the descriptive analysis just concluded. In particular, what is the effect on an intended analysis of SASS nonresponse in the 1990-91 round?

-- First, the "good news." SASS response rates are high overall. This is perhaps the best news for the analyst, since elaborate precautions may not be necessary.

-- Second, the "not-so-good news." SASS response rates are not easily summarized, so no quick rules of thumb are available as mnemonics. Grouping the seven components studied helps but only to a limited degree. In reality, the seven SASS components studied are all very different surveys; and, except for the economies of data collection, might best be considered separately.

-- Third, the frame variables examined in this chapter: urbanicity, school level, and school size were helpful in describing response patterns but often differences were small. Either there really are no strong patterns to see or the right variables were not used. This problem was particularly acute for the TDS survey but occurred elsewhere as well. Variables sought for the analysis but not found usable were some measure of minority enrollment and for teachers, both minority status and items like length of time teaching. The introduction of more complete frame variables would seem to be essential for any future analysis of SASS response rates.

-- Fourth, and related to the above, the variables looked at in this Chapter were all used in one way or another in the 1990-91 SASS nonresponse adjustment procedures. This means that the effect of any differential response noted here on an intended analysis is greatly mitigated. True, the differentials in response will increase[113] the variance but if the nonrespondents are otherwise "missing at random," there will be no resulting bias.

-- Fifth, what was desired initially, but not possible, was to systematically study at least one other important variable not involved in the nonresponse adjustment. Had this been possible, the issues of nonresponse bias could be covered to some degree.[114] There was one other (minor) variable looked at; but not fully studied -- whether the selected 1990-91 school had been in a

[112] Appendix B provides full details of the weighted and unweighted response rates, both actual and predicted by the modeling done.

[113] To counteract this variance impact, of course, larger samples might be drawn initially. A better strategy would be to reduce differential rates, where possible, by improving the SASS components and categories where response was on the lower end of the range.

[114] As already noted, one candidate explored was to attempt to look separately at schools by the fraction of their student population who were minority. This attempt proved unsuccessful because no usable value was available from the nonresponding schools on the computer file available for this study.

previous SASS round. In this case, virtually no differential was found in response rates, certainly an encouraging sign.

A final comment. Throughout this Chapter, the effects of state/association have been alluded too; but not dealt with fully. though. Tables 3.9.6 and 3.9.7 which follow, though, do permit at least the beginnings of an overall examination. Frankly, as will be seen in Chapter 4, state/association are much more important in most cases than the other frame variables examined. Put another way, for analysts looking at SASS by state or association concerns about response rates remain important and could even be serious. The modeling done in Chapter 4 should be of some help, though, plus the detailed tables given in Appendix B.

Table 3.9.6: Weighted response rates for public sector surveys by component and state: 1990-91 Schools and Staffing Survey.

(In Percent)

Item	District Survey	Administrator Survey	School Survey	Teacher Survey
U.S. Total	93.49	96.68	95.30	90.33
STATE				
Alabama	96.27	98.87	95.92	90.56
Alaska	96.15	96.57	92.00	89.82
Arizona	90.40	96.92	94.82	94.77
Arkansas	91.27	96.60	97.74	94.10
California	91.33	95.73	94.61	87.88
Colorado	98.24	98.44	95.87	95.16
Connecticut	76.96	97.04	93.10	85.65
Delaware	100.00	94.44	93.31	95.63
District of Columbia	100.00	88.88	86.26	69.40
Florida	92.04	94.41	93.94	88.71
Georgia	92.34	94.79	96.65	93.27
Hawaii	100.00	98.67	98.67	88.33
Idaho	95.50	100.00	98.62	95.25
Illinois	91.81	99.85	98.72	95.63
Indiana	95.79	100.00	99.61	95.28
Iowa	98.38	99.00	96.48	96.26
Kansas	99.63	98.05	97.99	95.61
Kentucky	92.33	98.95	98.07	88.82
Louisiana	90.10	93.68	93.88	93.12
Maine	92.06	98.25	94.66	89.76
Maryland	87.55	82.35	80.99	90.28
Massachusetts	94.07	96.52	91.14	84.40
Michigan	90.17	98.75	97.11	84.49
Minnesota	92.10	98.77	97.39	94.08
Mississippi	96.68	97.56	97.17	93.31
Missouri	93.80	98.93	98.01	91.19
Montana	95.08	99.78	97.81	94.97
Nebraska	97.32	98.26	98.69	92.92
Nevada	100.00	97.78	96.14	88.49
New Hampshire	92.92	98.83	96.33	92.54
New Jersey	86.28	92.37	88.31	86.32
New Mexico	95.02	99.13	96.01	90.31
New York	95.75	89.51	87.62	79.23
North Carolina	94.01	95.64	92.63	96.01
North Dakota	94.43	99.15	98.37	95.79
Ohio	89.38	97.03	97.00	87.77
Oklahoma	98.49	99.09	96.27	93.77
Oregon	91.23	97.33	95.27	91.36
Pennsylvania	94.36	97.16	96.06	93.34
Rhode Island	91.92	97.05	96.49	87.46
South Carolina	92.81	98.60	96.55	91.09
South Dakota	98.18	98.58	98.52	95.01
Tennessee	100.00	97.49	98.06	92.95
Texas	95.22	98.11	97.40	91.48
Utah	96.05	99.34	98.40	97.88
Vermont	86.42	98.65	98.48	95.56
Virginia	90.68	95.34	92.21	90.74
Washington	96.98	93.67	92.58	88.11
West Virginia	98.18	99.65	98.20	94.77
Wisconsin	96.27	97.25	94.57	95.26
Wyoming	96.14	96.41	97.69	96.81
CENSUS REGION				
Midwest	94.11	98.62	97.64	92.10
Northeast	91.22	94.25	91.59	85.43
South	94.87	96.26	95.24	91.74
West	93.12	96.62	95.14	90.37

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School, Teacher, Administrator, and Teacher Demand and Shortage Questionnaires).

Table 3.9.6: Weighted response rates for public sector surveys by component and state: 1990-91 Schools and Staffing Survey.

(In Percent)

Item	Administrator Survey	School Survey	Teacher Survey
U.S. Total	90.05	83.95	84.31
AREA FRAME	83.44	74.03	74.04
LIST FRAME			
Associations of Military Colleges and Schools	95.45	90.91	88.40
National Catholic Education Association, and Jesuit Secondary Education Association	96.24	90.92	88.39
Friends Council on Education	93.75	90.63	87.26
National Association of Episcopal Schools	93.73	89.39	83.82
Hebrew Day Schools	86.06	70.76	60.05
Solomon Schechter Day Schools	97.87	85.11	84.02
Other Jewish	72.39	70.36	57.12
Lutheran Church - Missouri Synod	97.34	96.07	94.83
Evangelical Lutheran Church - Wisconsin Synod	97.51	97.89	92.06
Evangelical Lutheran Church in America	98.85	95.51	86.53
Other Lutheran	97.30	94.17	89.46
General Council of Seventh-Day Adventists	94.93	93.91	81.70
Christian Schools International	94.25	93.68	90.10
American Association of Christian Schools	73.38	59.03	69.92
National Association of Private Schools for Exceptional Children	94.73	86.49	76.00
American Montessori Society Schools	92.17	85.46	76.76
National Association of Independent Schools	93.65	84.60	84.95
All Else	85.03	81.11	83.84
CENSUS REGION			
Midwest	92.41	85.72	86.90
Northeast	91.06	85.33	83.51
South	85.71	80.34	83.99
West	91.01	84.32	81.90

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School, Teacher, and Administrator Questionnaires).

Chapter 4 Inferential Analysis of SASS Response Rates

4.1 Introduction

This Chapter reexamines the response rate data from the 1990-91 Schools and Staffing Survey (SASS). Unlike Chapter 3, which had a descriptive focus, the goal here is to find, if possible, a parsimonious highly predictive model of the variation in response rates. The variables available for this effort are basically the same ones looked at earlier: urbanicity, school level, school size, region, state (for public schools), and association (for private schools).

The modeling is exploratory in nature. Indeed, the Chapter has been laid out as a story of the steps taken so far. Organizationally, it begins with this brief introduction (Section 4.1). Initial modeling efforts, done at the national level, are covered in Section 4.2. These did not really seem to work very well in that strong simple predictive models did not emerge. This failure led to the development of groups (clusters) of states or associations (as discussed in Section 4.3). Once clustered into relatively homogeneous groupings, it was possible to look at the data in more detail. This was first done cluster by cluster (in Section 4.4) and then an overall "final" model was fit and studied (Section 4.5). Here, again, difficulties were encountered; but, nonetheless, a deeper knowledge of response differences was achieved. In a concluding section (Section 4.6), the need to try still other analytic techniques and better predictive variables is also touched upon; but only tentative suggestions are offered as to what might be done next.

4.2 Initial Modeling Effort

The objective of the initial mathematical modeling, described in this Section was to test the effect on response rates of urbanicity, school level and school size. Separate models were developed for the Public/Private School Surveys; the Public/Private School Administrator Surveys; the Public/Private School Teacher surveys; and, finally, with some differences for the Teacher Demand and Shortage Survey.

A comparable, simply structured, complete logistic regression model was used for each analysis. The logistic model employed was

$$g(x) = b_0 + \sum_{i=1}^{2} b_{1i} x_{1i} + \sum_{j=1}^{2} b_{2j} x_{2j} + \sum_{k=1}^{3} b_{3k} x_{3k}$$

where $P(Y=1|x) = \pi(x)$ is defined as the conditional probability that the outcome is present and

$$(x) = \frac{e^{2g(x)}}{1+e^{2g(x)}}.$$

In this model parameterization, the x's are "dummy" variables, taking on the value of 1 if the characteristic is present and zero otherwise. In particular the x_{1i}, i=1, 2 are "dummy" variables coding urbanicity, x_{2j}, j=1,2 the variables coding school level, and x_{3k}, k=1,2,3 the variables coding school size.[115] In the interest of parsimony, no variable interactions (the combined effect of two or more variables) entered into the model.[116]

For the Teacher Demand and Shortage Survey the frame variables used were LEA urbanicity, the number of schools in the LEA and the number of students in the LEA. The "dummy" variables which entered into the model were as follows:

x_{1i}, i=1, 2 coding LEA urbanicity
x_{2j}, j=1 coding number of schools in LEA
x_{3k}, k=1,2,..,6,7 coding the number of students in LEA

In table 4.2.1 below, the fitted values for selected coefficients are given, with the estimated standard error of each coefficient shown in parentheses beneath it. The table also provides two more lines; an overall "degree of fit" measure and the average weighted response rates (from Chapter 3).

Note, only the public and private school sample results are presented. This decision will be discussed first; then there will be an explanation of the coefficients or effects shown in the table. Finally, the "degree of fit" measures will be commented on, since they form a nice transition to what happened next.

SASS Component Results. --Results similar to those in table 4.2.1 were prepared for all the seven SASS components studied in Chapter 3. While each deserves a brief comment, it did not seem necessary to look at all of them separately. The reasons for this are similar to those given in Section 3.9 above. In particular, the formal models of this Chapter confirm the earlier observations about dividing up the seven SASS components into three groups: the TDS survey, the private sector surveys and the remaining public sector surveys.

-- The TDS model is not presented, because, as was seen earlier, the frame variables simply do not predict the response rates very well; in other words, the TDS variables have little or no seeming effect on nonresponse. In particular, none of the TDS model coefficients were statistically significant.

---

[115] To create this parameterization, the levels of each variable are listed alphabetically -- for example, for urbanicity, these are rural/small town, suburban (urban fringe/large town), and urban (central city). According to the dummy variable conventions, each dummy (except the last) is set to 1 for, say, "rural" and zero otherwise. In order for the resulting X'X matrix (of all the dummy variables) to be inevitable, the last class for each variable is always suppressed. This means that the other effects are all measured relative to the last class. In table 4.2.1, this is, in fact, what has been done. For urbanicity, to stay with the same example, table 4.2.1 shows two effects, d's. The first of these measures the effect on response of being in a rural area versus being in the central city. The second urbanicity effect measures the differential in response between being in a urban fringe/ large town versus the central city.

[116] In the statistical testing done, none of these interactions were found to be significant globally.

-- The private sector surveys, as described in Chapter 3, all had a similar pattern of response and this turned out to be true when they were formally modeled too. Arbitrarily, the private school sample was chosen to represent the entire sector in table 4.2.1.

-- The public sector surveys (except for the TDS), also turned out to be fairly similar when formally modeled. The public school survey represented the median of this sector quite well and was chosen to parallel the private school sample in the discussions to follow[117].

Reading Model Coefficients -- To read table 4.2.1, it is necessary to understand that the coefficients or effects shown are in the form of relative log odds; In table 4.2.1, the reference class is all secondary schools with 750 or more students in the central city. For such schools, the chance of responding, as given from the model is 94.56% for public schools and 85.25% for private schools.[118] It is enough for present purposes to grasp that when the effects are positive, this indicates that a higher response rate is predicted. When the effects are negative, a lower than reference rate is anticipated. For effects near zero, the variable is expected to have little or no influence.

Given this background, consider what would happen if 90 % confidence intervals are formed of the sort --

[117] In tables 3.9.3 to 3.9.5, it was nearly always (nine out of ten) the public school sample response rates which were at the median for the public sector (excluding TDS). Incidentally, for the private sector, there was enough similarity between the school and teacher response rates that the two alternated about equally as to which was at the median. It must be admitted that some discomfort remains in trying to summarize the very complex response rate structure looked at in this report by simply picking median valued samples. This is especially true when trying to characterize the private school administrator sample which had an unaccountably higher response than did the corresponding private school survey. This difference remains unexplained and deserves more study, especially since a similarly large difference did not occur between the public sector counterparts. It is, though, comforting to find that at the modeling stage all three private sector surveys show the same pattern as to their effects. The algebraic signs are all the same; what turns out to be significant also agrees (at a nominal, say, α=10% level).

[118] The only $\hat{b}$ that enters in is that for the reference group (1.4275 as shown in table 4.2.1). To get the response rate (x) simply substitute g(x) = 1.4275 in the expression for $\pi(x)$ above; similarly for private schools, with g(x) = 0.8773. If the school was public and elementary but otherwise the same size and in a large central city, then g(x) = +0.0436 +1.4275 = 1.4711. Substituting this value of g(x) into $\pi(x)$ would yield a predicted response of 94.99% percent. The school with the highest response, as predicted from the model, is a small elementary school in a rural area -- for which the chance of being a respondent would be 97.73% percent (i.e., g(x) = +.0436 +0.0697 +0.3410 +1.4275 = 1.8818).

Estimated Coefficient - 1.645(Standard Error) < b < Estimated Coefficient - 1.645(Standard Error).

Or,

$$\hat{b} - (1.645)\,\hat{}_{\hat{b}} < b < \hat{b} + (1.645)\,\hat{}_{\hat{b}}$$

Where $\hat{b}$ is the value of b estimated from the SASS component and $\hat{}_{\hat{b}}$ is the estimated standard error adjusted for the complex structure of the SASS sample.

Table 4.2.1 -- Initial overall response model coefficients for 1990-91 SASS public and private school components

(Standard errors underneath the coefficients in parentheses)

Effect	Public	Private
Reference Group*	+1.4275**	+0.8773**
	(0.0522)	(0.0831)
Urbanicity		
Rural vs. Central City	+0.3410**	+0.0428
	(0.0511)	(0.0335)
Suburban vs. Central City	-0.1373**	-0.0146
	(0.0457)	(0.0303)
School Level		
Combined vs. Secondary	-0.1230	-0.1520**
	(0.0971)	(0.0362)
Elementary vs. Secondary	+0.0436	+0.0586**
	(0.0605)	(0.0328)
School Size		
1 to 149 vs 750 or More	+0.0697	-0.1679**
	(0.0976)	(0.0459)
150 to 499 vs. 750 or More	+0.0325	+0.0566
	(0.0548)	(0.0435)
500 to 749 vs. 750 or More	+0.0210	-0.0293
	(0.0632)	(0.0610)
Degree of Fit	21.4%	27.1%
Response Rate	95.3%	84.0%

* Secondary schools with 750 or more students in central cities.

** Statistically significantly different from zero at the α=0.10 level (i.e., the 90% confidence interval does not contain zero).

NOTE: Response rates are based on weighted data taken from Chapter 3 and appendix B. Degree of fit measures are obtained as described in text.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public and Private School Questionnaires).

Adopting this convention it is apparent that the true value for each $\hat{b}$ in table 4.2.1 could be zero in many cases.[119] Put another way, with confidence intervals of this size, the following coefficients would be statistically significantly different from zero:

-- For public schools both urbanicity effects are statistically significant, especially the much greater chance of responding if the school was in a rural area versus a central city. Contrast this with private schools where the urbanicity variable seems to have no real effects at all. Both urbanicity private school effects are close to zero and are not statistically significant.

-- For school level, the significance of the variables reverses -- with combined private schools being significantly less likely to respond than private secondary schools. The same pattern exists for combined public schools; indeed the effect is almost the same size (-.1230 versus -.1520); but for public schools the result is not statistically significant. For elementary versus secondary, there is a small (significant for private school) increase in response rates for elementary versus secondary. Again, the similarity across sectors suggests that the effect should be taken as having some importance.

-- For the school size effects, there was only one case of a statistically significant result. Small private schools were significantly less likely to respond. In the public school sample, though, there was a pattern of decreasing likelihood of response as school size increased.[120]

Degree of Fit. -- As mentioned earlier, to get an overall measure of the success of these models, an examination was conducted of the extent to which the model explained the variation in response rates by state or for private schools by association. What happened specifically was that models, like those in table 4.2.1, were fit to data by state/association for each of the seven SASS components. The residuals were then examined to look at the fits. An example of this step is shown in Appendix A.

Suffice it to say, the models did a very poor job of predicting response rates separately by state/association. The degree of fit measure in table 4.2.1 captures this weak result quite well. If the degree of fit had a value of 100%, then, just like a coefficient of determination in ordinary regression, the predictive power of the model would have been perfect. Conversely, a value of zero means that the model has no predictive power.

The values for the degree of fit actually obtained, about 21% for public and 27% for private schools, suggest the modeling was singularly ineffective -- explaining only a very small

[119] Conventionally, a nominal 95% confidence interval might have been used; but, as elsewhere in this report, because of the exploratory nature of the approach taken, a 90% interval seemed appropriate. This level gives the data more of a chance to suggest ideas that could be followed up for the future.

[120] There was a statistically significant difference between the smallest and largest public schools mentioned in Chapter 3. Recall also from Chapter 3 that it was the small schools in the rural South that were principally responsible for the falloff in response for private schools with 1 to 149 students. Except for this "possible interaction" effect, the pattern by size of school might have been fairly similar between public and private.

portion of the total state or association differences in response rates.[121] In view of these results, the idea of a simple national response model was abandoned. Instead, the objective became to reduce the variability due to the states/associations -- the overriding goal still being to concentrate on the variation caused by the other frame variables. Therefore, there was an attempt to cluster the states/associations, as is discussed in the next Section.

4.3 Clustering Response Rates

To cluster the states/associations, the logistic model was altered from that in Section 4.2. In particular, it included a set of terms, x_{4g} , for state/association groups as given below:

$$g(x) = b_0 + \sum_{i=1}^{2} b_{1i}\, x_{1i} + \sum_{j=1}^{2} b_{2j}\, x_{2j} + \sum_{k=1}^{3} b_{3k}\, x_{3k} + \sum_{g=1}^{4} b_{4g}\, x_{4g}$$

where, as before, x_{1i}, i=1,2, 3 are the dummy variables coding urbanicity, x_{2j} j=1,2,3 the variables coding school level, x_{3k}, k=1,2,3,4 the variables coding school size; but, this time, there are additional (dummy) variables, x_{4g}, g=1,2,..,m coding state/association groupings (tables 4.3.2 and 4.3.3). No variable interactions (the combined effect of two or more variables) entered into the model.

The final clusters were selected through a stepwise procedure which began with a baseline model containing all frame variables and placing all states/associations in one group. As noted, the objective was to reduce the variability in response due to the states/associations in order to concentrate on the variation caused by the other frame variables. Therefore, the successive

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[121] To get an overall measure of the success of these models, an examination was conducted of the extent to which the model explained the variation in response rates by state or for private schools by association. In keeping with the coefficient of determination, familiar from ordinary regression, a degree of fit measure was calculated by comparing the weighted state/association response rates with the overall national rates (as shown in table 4.2.1) -- then with what would have been predicted under the initial model shown. While more than one distance measure was examined, the fit values shown in table 4.2.1 were derived by dividing

$$\sum_{\text{State/Association}} \left[\hat{}(\text{Actual}) - \hat{}(\text{Model}) \right]^2 \quad \text{by} \quad \sum_{\text{State/Association}} \left[\hat{}(\text{Actual}) - \hat{}(\text{National}) \right]^2$$

This quantity can be interpreted as the remaining lack of fit under the model (numerator) relative to the overall departure in the data from the simple weighted national response rate (denominator). The percent explained, as shown in the table, is one minus this quantity. Computational limitation forced this type of compromise. For more on the issues here and a discussion of other measures, see Hosmer, D. and Lemeshow, S. (1989) *Applied Logistic Regression*. Wiley: New York. See also Morel, J. (1989). "Logistic Regression Under Complex Surveys." *Survey Methodology*, 15(2): 203-223; and Srivastava, M. and Carter E. (1986). "The Maximum Likelihood Method for Non-response in Sample Surveys." *Survey Methodology* 12(1): 61-72.

As noted in the text, for the public school SASS component the initial model explained about 21% of the state-to-state variation from the national rate. The proportion of the explained variation differed considerably across components. The explanatory power was virtually nil for the Teacher Demand and Shortage survey. For the other SASS components the percentages explained were larger about 20% (Public Administrator), 25% (Private Administrator), 27% (Private School), 24% (Public Teacher), and 23% (Private Teacher). Incidentally, the seemingly better fits in most cases from the private sector sample are hard to interpret since the number of states (50 plus the District of Columbia) is over twice the number of associations being modeled.

models fit included all frame variables and differed only in how they divided states/associations into groups.

The fit was evaluated on the basis of how well it estimated response at the state/association level. A t-value was calculated for each state/association comparing the observed and fitted response rates. The test was adjusted using the percentage average design effect at the state/association level as follows

$$\frac{\text{Response Rate - Estimated Response Rate}}{\sqrt{(\text{Design Effect})\dfrac{(\text{Response Rate})(1 - \text{Response Rate})}{\text{Sample Size}}}}$$

The criterion for segregating states in the successive models was that the t-value be less than -2 or greater than + 2 . This is the usual nominal two-tail t-test at the 5 percent significance level, for large samples. The design effects used are shown in table 4.3.1 below.

Table 4.3.1 -- Survey design effects: Schools and Staffing Survey, 1990-91.

Survey	Design Effect
Public School	1.7422
Public School Administrator	1.7807
Public School Teacher	2.8493
Teacher Demand and Shortage	1.8603
Private School	2.0488
Private School Administrator	2.3694
Private School Teacher	1.9053

SOURCE: Salvucci, S. and Weng, S. (1995),op. cit.

In the course of the modeling procedure, plots of observed versus fitted response rates were used to graphically identify outliers. An outlier was either assigned to a state/association group by itself or to a group of states/associations of comparable response rate already formed in a preceding model. In some instances states or associations which did not violate the t-value criterion but appeared to be outliers in the plots were also placed into groups. Therefore, the division of states/associations into groups by this procedure was not unique. For each component, the smallest cluster contained at least two states/associations.

For this effort, the (recursive) procedure began by fitting the data to a complete, baseline model which contained all three categorical sampling frame variables and all of the states/associations without groupings. If the t-value criterion by state was not violated the

modeling procedure was terminated; otherwise the plot[122] of the estimated response rate versus the actual response rate was used to identify outliers, the groups were redefined, a new model was fitted, and the cycle repeated.

For each of the public school components (see table 4.3.2), the modeling procedure resulted in different state groups. In the final model there were five state groups for the Public School Survey (coded with m=4 dummy variables), for the Public School Administrator survey there were four state groups (m=3), six for the Public School Teacher Survey (coded with m=5 dummy variables), and four for the Teacher Demand Survey (coded with m=3 dummy variables).

Similarly, for each of the private school components the modeling procedure resulted in different association groups (see table 4.3.3). In the final model there were four association groups for the Private School Survey (m=3), three for the Private School Administrator survey (m=2), and five for the Private School Teacher survey (m=4).

[122] And associated t-values.

Table 4.3.2 -- Group composition: Schools and Staffing Survey 1990-91, Public School Component.

(Range of response rates for each group shown in parentheses. Note ranges sometimes overlap due to the fitting method employed.)

Group	Administrator	School	Teacher	TDS
1	District of Columbia Maryland New York	District of Columbia Maryland New Jersey New York	District of Columbia New York	Connecticut Maryland New Jersey Vermont
	(82.3%-89.5%)	(81.0%-88.3%)	(68.5%-79.6%)	(77.0%-87.5%)
2	Idaho Illinois Indiana Montana Utah West Virginia	Alaska Massachusetts	Alabama Alaska California Connecticut Florida Hawaii Kentucky Maryland Nevada New Jersey New Mexico Ohio Rhode Island Washington	Colorado District of Columbia Delaware Iowa Kansas Nebraska Nevada Oklahoma South Dakota Tennessee West Virginia Washington
	(99.3%-100.0%)	(91.1%-92.0%)	(86.3%-91.0%)	(97.0%-100.0%)
3	Louisiana New Jersey Washington	Hawaii Illinois Indiana Utah	Massachusetts Michigan	California Montana North Dakota Oregon
	(92.4%-93.7%)	(98.7%-99.6%)	(84.3%-84.8%)	(91.2%-95.1%)
4	Remaining States	Connecticut Delaware North Carolina Virginia Washington	Illinois Utah	Remaining States
	(94.4%-99.2%)	(92.2%-93.3%)	(96.4%-97.7%)	(90.1%-100.0%)
5		Remaining States	Texas Virginia	
		(93.9%-98.7%)	(91.6%-91.7%)	
6			Remaining States	
			(86.6%-96.5%)	

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Table 4.3.3 -- Group composition: Schools and Staffing Survey 1990-91, Private School Component.

(Range of response rates for each group shown in parentheses. Note ranges sometimes overlap due to the fitting method employed.)

Group	Administrator	School	Teacher
1	Area Frame National Society of Hebrew Day Schools Other Jewish American Assoc. of Christian Schools All Else (72.4%-86.1%)	Area Frame National Society of Hebrew Day Schools Other Jewish American Assoc. of Christian Schools (59.0%-74.0%)	National Society of Hebrew Day Schools Other Jewish American Assoc. of Christian Schools (59.8%-63.5%)
2	Evangelical Lutheran Church in America Evangelical Lutheran Church-Wisconsin Synod Lutheran Church-Missouri Synod Other Lutheran Solomon Schechter Day Schools (97.3%-98.9%)	Evangelical Lutheran Church in America Evangelical Lutheran Church-Wisconsin Synod Lutheran Church-Missouri Synod (95.5%-97.9%)	Assoc. of Military Colleges & Schools Christian Schools International Evangelical Lutheran Church-Wisconsin Synod Lutheran Church-Missouri Synod Other Lutheran (90.3%-94.8%)
3	Assoc. of Military Colleges & Schools Catholic Christian Schools International Episcopal Friends Montessori National Assoc. of Independent Schools National Assoc. of Private Schools for Exceptional Children Seventh-Day Adventist (92.2%-96.2%)	Montessori National Assoc. of Independent Schools National Assoc. of Private Schools for Exceptional Children Solomon Schlechter Day Schools All Else (81.1%-86.5%)	Area Frame Montessori (75.0%-76.9%)
4		Assoc. of Military Colleges & Schools Catholic Christian Schools International Episcopal Friends Other Lutheran Seventh-Day Adventist (89.4%-94.2%)	Catholic Solomon Schechter Day Schools (85.7%-88.0%)
5			Episcopal Evangelical Lutheran Church in America Friends National Assoc. of Independent Schools National Assoc. of Private Schools for Exceptional Children Seventh-Day Adventist All Else (79.2%-86.0%)

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

4.4 Detailed Modeling Effort

In this Section, a further look will be taken at the frame variables -- but now fit separately within clusters. In particular, the key question here is what was the impact of urbanicity, school level and enrollment size within clusters and how did these impacts change as the cluster response rate changed. Again, because the results are broadly similar for all SASS components only two will be presented: (1) the public school component and (2) the private school component.

4.4.1 Public School Component

Shown below in table 4.4.1, by cluster, are the associated model coefficients for urbanicity, school level and school size for the public school component of SASS. In parentheses beneath each of the estimated coefficients $\hat{b}$'s, are their associated standard errors.[123]

To read the table, it must be remembered that the effects $\hat{b}$ are again in the form of coefficients in the expression g(x) where

$$g(x) = b_0 + \sum_{i=1}^{2} b_{1i} x_{1i} + \sum_{j=1}^{2} b_{2j} x_{2j} + \sum_{k=1}^{3} b_{3k} x_{3k}$$

is fit separately within each group. Now, as before, when the effects are positive, this indicates that a higher response rate is predicted than that of the reference group.[124] When the effects are negative, a lower than average rate is anticipated.

For effects near zero, of course, the variable is expected to have little or no influence. Now, as in Section 4.2, approximate 90 % confidence intervals can be formed of the sort

Estimated Coefficient - 1.645(Standard Error) <b < Estimated Coefficient - 1.645(Standard Error).

It turns out, unlike in Section 4.2, that within clusters the true value for the b's in table 4.4.1 may be zero in nearly every case. The implications of these results will be discussed.

[123] These standard errors, of course, have been adjusted by the appropriate design effect. See Salvucci, S. and Weng, S. (1995). op. cit. The coefficients in this Section differ from those to be covered in Section 4.5 in that they have been fit separately within each cluster. This formulation allows for a potential interaction between the frame variables and the cluster itself.

[124] The reference group is still secondary schools in central cities with 750 or more students, but this time within clusters.

Table 4.4.1.--SASS public school component: effects of urbanicity, school level and school size on response by cluster.

(Standard errors underneath the coefficients in parentheses)

Effect	Cluster or Group Number 1	Number 2	Number 3	Number 4	Number 5
Reference Group*	+.8614**	+.9995**	+1.3899**	+1.0712**	+1.5229**
	(.1454)	(.2700)	(.4914)	(.3627)	(.0665)
Urbanicity					
Rural v. Central city	+.2928**	+.4490**	+1.2623**	+.4751**	+.2575**
	(.1468)	(.2325)	(.6683)	(.1589)	(.0651)
Suburban v. Central City	-.1333	+.0900	-.6385	-.0354	+.1169**
	(.1072)	(.2140)	(.5271)	(.1437)	(.0633)
School Level					
Combined v. Secondary	-.2358	-.4405	-.6235	-.1814	-.1225
	(.2887)	(.6497)	(.8579)	(.6771)	(.1222)
Elementary v. Secondary	+.0542	-.2206	+.6213	+.1038	+.0915
	(.1657)	(.5153)	(.5943)	(.3545)	(.0768)
School Size					
U150 v. 750 or More	-.00147	+.1796	-.5769	-.2503	-.0152
	(.4712)	(.7019)	(.7186)	(.4408)	(.1083)
150 to 499 v. 750 or More	+.0726	+.2262	-.5298	+.0463	+.0640
	(.1887)	(.4569)	(.8019)	(.2030)	(.0698)
500 to 749 v. 750 or More	+.0611	+.4476	n/a	n/a	+.0965
	(.1985)	(.4657)	n/a	n/a	(.0857)
Response Rate	86.8%	91.3%	98.9%	92.6%	96.5%

* Secondary schools with 750 or more students in central cities.

** Statistically significantly different from zero at the α=0.10 level (i.e., the 90% confidence interval does not contain zero).

NOTE: Response rates are based on weighted data taken from Chapter 3 and appendix B. Degree of fit measures were obtained as described in text. Groups are defined in table 4.3.2.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

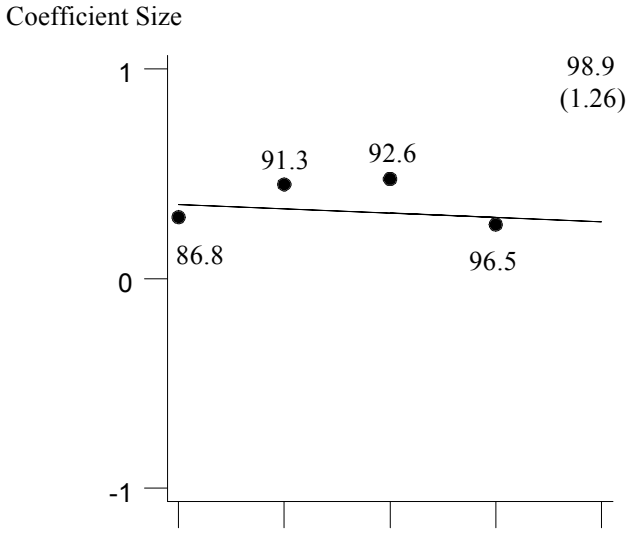
Statistical significance of individual effects. -- Most of the frame variables have no additional important effects within clusters -- once the clustering of response rates by state has been done. In other words, the SASS public school response rates are best predicted, in most cases, by simply knowing the state or state group that the school is in. The chief exceptions are for public schools by urbanicity. For all five clusters, rural/small town schools are significantly more likely to respond to SASS than are otherwise comparable central city schools. A statistically significant difference also exists for urban fringe/large town schools in cluster 5 (which contains the bulk of the states). Further examination of table 4.4.1, though, does not reveal any other individually significant effect; indeed, few are close to nominally significant, even at the $\alpha = .20$ level. Put another way, under the original model of Section 4.2, the only overall effect was for urbanicity; and, indeed, this is all that was found after the clustering too. That is why in Chapter 3 separate maps of response rates were produced by urbanicity.

Patterns across clusters -- The effects, even though not often individually significant, can still be used to look for collective patterns across clusters. This has been done in the plots which follow. Each figure 4.4.1 to 4.4.7 takes a row of table 4.4.1 and graphs the response effects, ordering the clusters from highest to lowest in overall response rate. A regression[125] line has also been added so that trends are evident. Each of these figures is discussed separately beginning here and continuing on the pages which follow.

[125] Because the variance of each effect is estimated to be quite different, a weighted regression was done, using the inverses of estimated variances as weights.

Figure 4.4.1 clearly shows virtually no trend in relative response rates as the clusters increase in overall response. In other words, the advantage of being a rural/small town school continues when moving from states with low response rates to those with higher ones. Neither the slope nor the intercept for the regression were statistically significant, however. For example, the P-value for statistical significance of the slope coefficient is 0.7396, where a value of α= .10 or less would be needed, if the convention of 90% confidence intervals is maintained.

Figure 4.4.1 -- SASS Public School Component: Differential Response Rate Effect, Rural versus Central City, by Cluster.

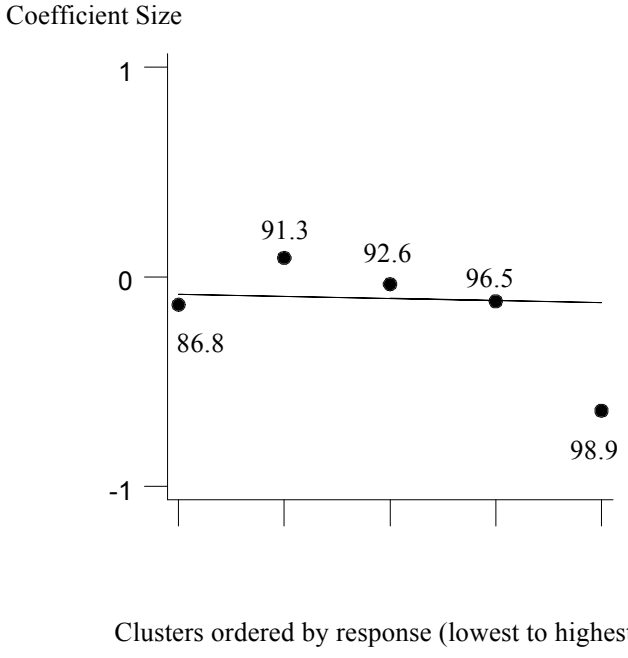


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.1. The corresponding rates are 86.8% for group 1; 91.3% for group 2; 98.9% for group 3; 92.6% for group 4; and 96.5% for group 5. Group 3 has a coefficient of 1.26 and has been shown in parentheses.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure 4.4.2 clearly shows no discernible trend in relative response rates as the clusters increase in their level of response. In this case, as would be expected, neither the slope nor the intercept for the regression were statistically significant. Here the P-value for statistical significance of the slope coefficient is .7883, where a value of $\alpha = .10$ or less would be needed, if the convention of 90% confidence intervals is maintained.

Figure 4.4.2 -- SASS Public School Component: Differential Response Rate Effect, Rural versus Urban fringe/large town, by Cluster.

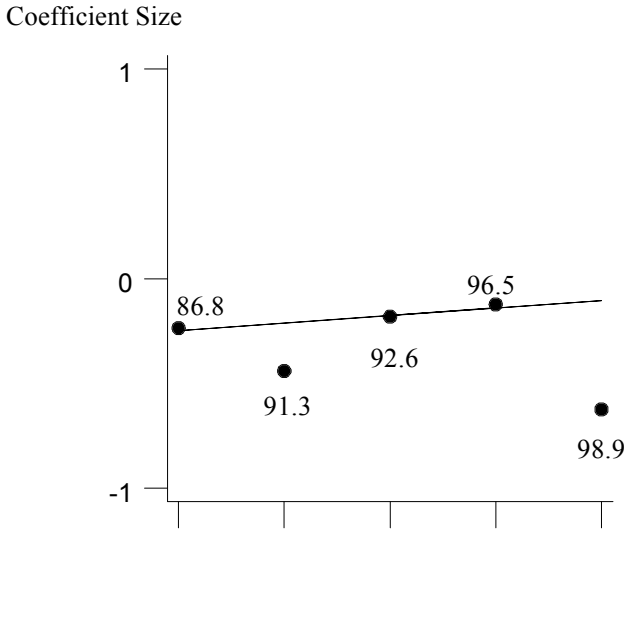


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.1. The corresponding rates are 86.8% for group 1; 91.3% for group 2; 98.9% for group 3; 92.6% for group 4; and 96.5% for group 5.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure 4.4.3 shows a very slight upward trend in relative response rates as the clusters increase in their level of response. Said another way, combined school response rates grow less different relative to secondary school rates as the states increase in their degree of response. However, neither the slope nor the intercept for the regression were statistically significant. The P-value for statistical significance of the slope coefficient is 0.4490, not at all close to significance. With so few combined schools, this result could have been predicted ahead of time.

Figure 4.4.3 -- SASS Public School Component: Differential Response Rate Effect, Combined Schools versus Secondary Schools, by Cluster.

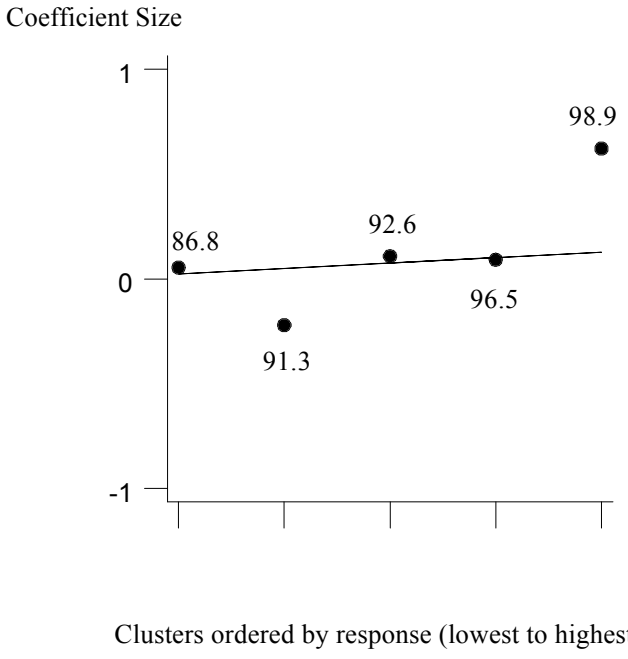


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.1. The corresponding rates are 86.8% for group 1; 91.3% for group 2; 98.9% for group 3; 92.6% for group 4; and 96.5% for group 5.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure 4.4.4 shows a mixed but generally upward trend in relative response rates as the clusters increase in their level of response. Elementary school response rates grow closer to those for secondary schools as the states increase in their degree of response. As is obvious from the plot, neither the slope nor the intercept for the regression were statistically significant. The P-value for the slope coefficient was 0.5142.

Figure 4.4.4 -- SASS Public School Component: Differential Response Rate Effect, Elementary Schools versus Secondary Schools, by Cluster.

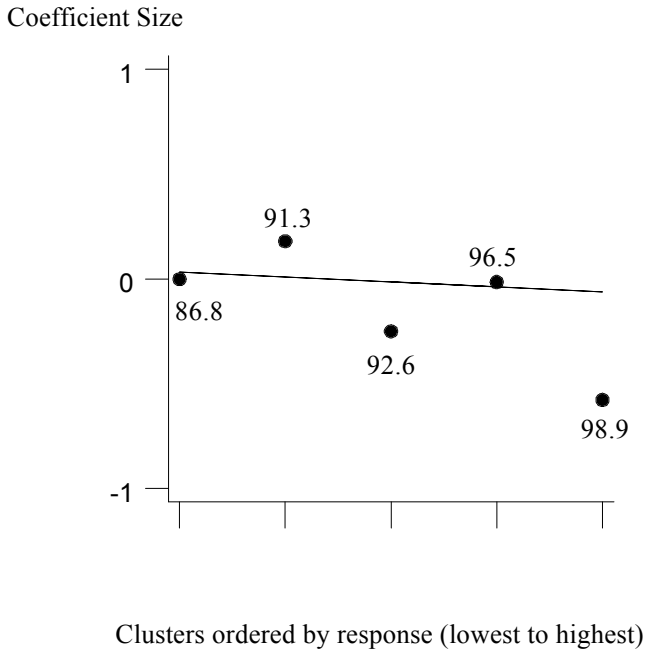


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.1. The corresponding rates are 86.8% for group 1; 91.3% for group 2; 98.9% for group 3; 92.6% for group 4; and 96.5% for group 5.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure 4.4.5 shows almost no trend in relative response rates as the clusters increase in their level of response. Schools with enrollment of 1 to 149 have response rates relative to schools with enrollment of 750 or more that vary little as the states increase in their degree of response. For the sake of completeness, the P-value for the slope coefficient is 0.7738, indicating almost a virtual certainty that there is no trend in these data by cluster.

Figure 4.4.5 -- SASS Public School Component: Differential Response Rate Effect, Enrollment 1 to 149 versus Enrollment of 750 or more, by Cluster.

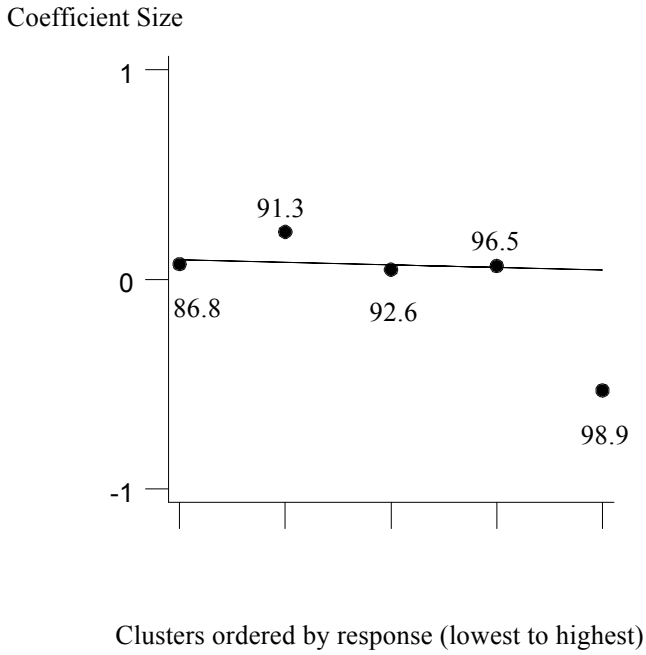


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.1. The corresponding rates are 86.8% for group 1; 91.3% for group 2; 98.9% for group 3; 92.6% for group 4; and 96.5% for group 5.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

The coefficients plotted in figure 4.4.6 suggests that the relative response rates by school size are reduced as the clusters increase in their overall level of response. The P-value for the slope coefficient was 0.7159 and hence not significant. Visually there appears to be no trend as well.

Figure 4.4.6 -- SASS Public School Component: Differential Response Rate Effect, Enrollment of 150 to 499 versus Enrollment of 750 or more, by Cluster.

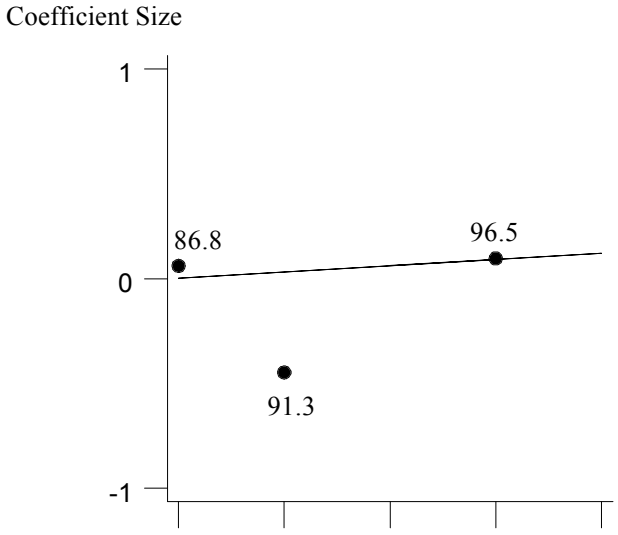


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.1. The corresponding rates are 86.8% for group 1; 91.3% for group 2; 98.9% for group 3; 92.6% for group 4; and 96.5% for group 5.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure 4.4.7 shows a mild, but not statistically significant upward trend in relative response rates as the clusters increase in their level of response. The P-value is 0.7633. This is so despite the very high values for conventional fit statistics. The adjusted R^2 value, for example, is 0.6644 -- quite respectable, with the unadjusted R^2 value being 0.8322. Schools with enrollment 500 to 749 have response rates relative to schools with enrollment of 750 or more that tend to decline as the states increase in their degree of response.

Figure 4.4.7 -- Public School Component: Differential Response Rate Effect, Enrollment 500 to 749 versus Enrollment of 750 or more, by Cluster.



NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.1. The corresponding rates are 86.8% for group 1; 91.3% for group 2; 98.9% for group 3; 92.6% for group 4; and 96.5% for group 5.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

4.4.2 Private School Component

Shown on the next page, in table 4.4.2, by cluster, are the associated model coefficients for private schools for urbanicity, school level and school size. As before, in parentheses beneath each of the coefficients, $\hat{b}$'s, are their associated standard errors.[126] Also, each of the lines of table 4.4.2 has been plotted to look at how the effects change as the cluster response rates increase.

Statistical significance of individual effects. -- Most of the frame variables have no additional important effects within clusters -- once the clustering of response rates by state has been done. In other words, the SASS private school response rates are best predicted, in most cases, by simply knowing the association or association group that the school is in. The chief exception is for private schools by urbanicity (i.e., the effect for urban fringe/large town is statistically significant. Further examination of table 4.4.2, though, does not reveal any other individually significant effect; indeed, few are close to nominally significant, even $\alpha = .20$ level.

Patterns across clusters -- The effects, even though not individually significant, can still be used to look for collective patterns across clusters. This has been done in the plots which follow, as figures 4.4.8 to 4.4.14 take a row of table 4.4.2 and graph the response effects, ordering the clusters from highest to lowest in overall response rate. A regression[127] line has also been added so that trends are evident. Each of these figures is discussed separately beginning here and on the pages which follow.

[126] These standard errors have been adjusted, as were the public schools, by the appropriate design effect. See Salvucci, S., Weng, S., and Kaufman, S. (1995). op. cit.

[127] Again, because the variance of each effect are estimated to be quite different, a weighted regression was done, using the inverses of estimated variances as weights.

Table 4.4.2 -- SASS 1990-91 private school survey: effects of urbanicity, school level and school size on response by cluster.

(Standard errors underneath the coefficients in parentheses)

Effect	Cluster or Group Number 1	Number 2	Number 3	Number 4
Reference Group*	+.5646**	+1.6332**	+.9441**	+1.1896**
	(.3006)	(.4427)	(.2202)	(.1451)
Urbanicity				
Rural v. Central city	-.1255	+.1287	+.1218	+.1952
	(.0801)	(.5383)	(.1077)	(.1668)
Suburban v. Central City	+.2084**	-.0370	+.00930	-.0243
	(.1011)	(.3865)	(.0968)	(.1229)
School Level				
Combined v. Secondary	-.2445**	-1.7137	-.2071	-.0251
	(.1380)	(1.2278)	(.1747)	(.1828)
Elementary v. Secondary	+.0630	n/a	-.0966	+.0137
	(.1411)	n/a	(.1806)	(.1329)
School Size				
U150 v. 750 or More	+.0392	-.00748	-.0356	+.4061**
	(.2792)	(.5460)	(.1648)	(.2161)
150 to 499 v. 750 or More	+.0788	n/a	+.0364	-.0180
	(.2911)	n/a	(.1728)	(.1475)
500 to 749 v. 750 or More	-.2490	n/a	-.2628	-.2094
	(.3816)	n/a	(.2442)	(.1918)
Response Rate	71.7%	96.5%	82.0%	91.3%

* Secondary schools with 750 or more students in central cities.

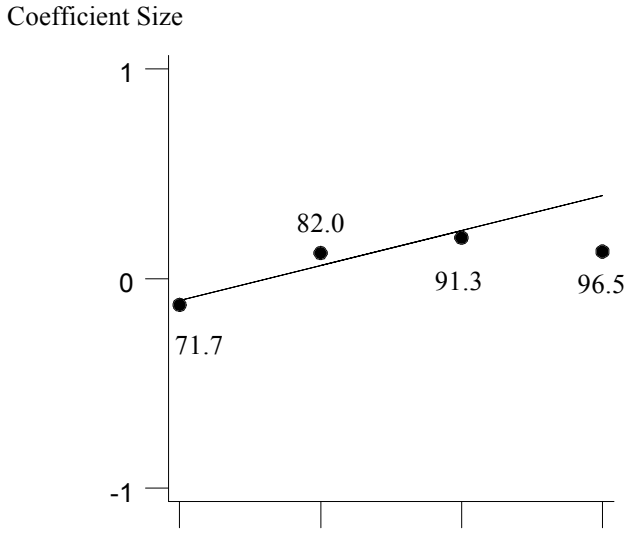
** Statistically significantly different from zero at the α=0.10 level (i.e., the 90% confidence interval does not contain zero).

NOTE: Response rates are based on weighted data taken from Chapter 3 and appendix B. Degree of fit measures were obtained as described in text. Groups are defined in table 4.3.3.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

Figure 4.4.8 shows a strong upward trend in relative response rates as the clusters increase in overall response. In other words, the advantage of being a rural/small town school increases when moving from associations with low response rates to those with higher ones. Both the slope and the intercept for the regression were statistically significant. For example, the P-value for statistical significance of the slope coefficient is 0.0664, where a value of α = .10 or less would be needed, if the convention of 90% confidence intervals is maintained.

Figure 4.4.8 -- SASS Private School Component: Differential Response Rate Effect, Rural versus Central City, by Cluster.

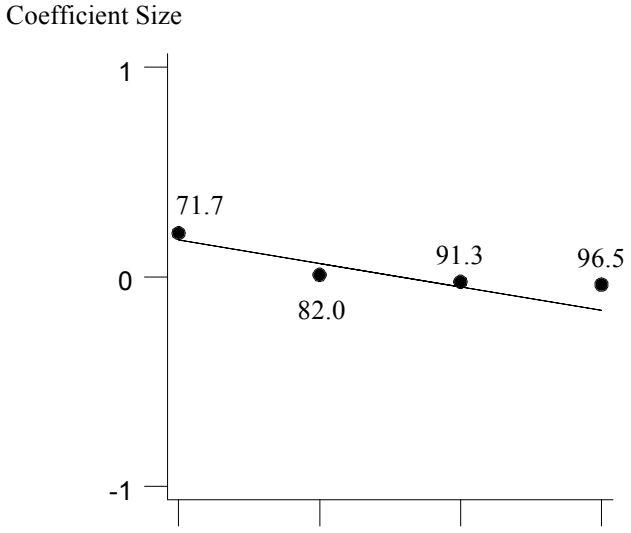


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.2. The corresponding rates are 71.1% for group 1; 96.5% for group 2; 82.0% for group 3; and 91.3% for group 4.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

Figure 4.4.9 shows a downward trend in relative response rates as the clusters increase in their level of response. Urban fringe/large town response rates less different than central city rates as the associations increase in their degree of response. Again, both the slope and the intercept for the regression were statistically significant. Here the P-value of the slope coefficient is 0.1006, where a value ofα = .10 or less would be needed, if the convention of 90% confidence intervals is maintained.

Figure 4.4.9 -- SASS Private School Component: Differential Response Rate Effect, Rural versus Urban fringe/large town, by Cluster.

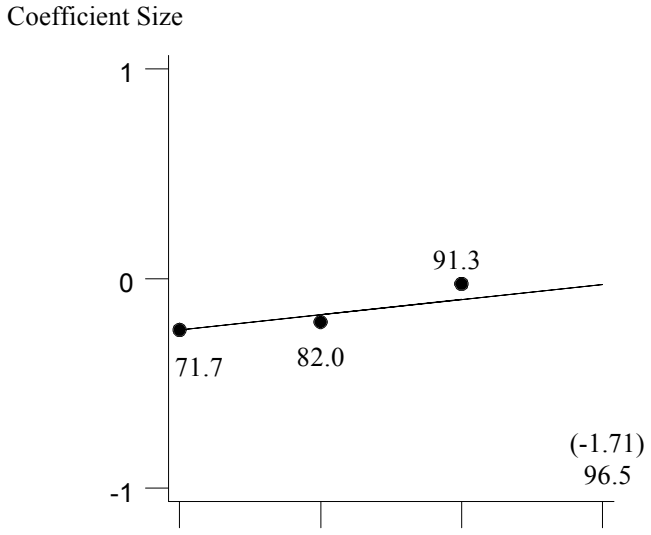


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.2. The corresponding rates are 71.1% for group 1; 96.5% for group 2; 82.0% for group 3; and 91.3% for group 4.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

Figure 4.4.10 shows an upward trend in relative response rates as the clusters increase their level of response. Combined school response rates grow better relative to secondary school rates as the associations increase in their degree of nonresponse. However, neither the slope not the intercept for the regression were statistically significant. Here the P-value of the slope coefficient is 0.1006, where a value of $\alpha = .10$ or less would be needed, if the convention of 90% confidence intervals is maintained.

Figure 4.4.10 -- SASS Private School Component: Differential Response Rate Effect, Combined Schools versus Secondary Schools, by Cluster.

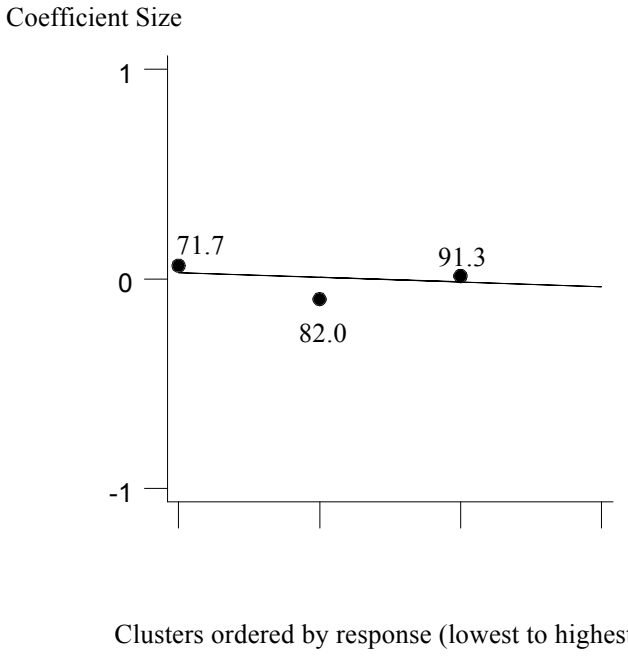


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.2. The corresponding rates are 71.1% for group 1; 96.5% for group 2; 82.0% for group 3; and 91.3% for group 4. Group 2 had a coefficient of -1.71 and has been shown in parentheses.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

Figure 4.4.11 shows virtually no trend in relative response rates as the clusters increase in their level of response. Elementary school response rates are slightly worse relative to secondary school rates as the associations increase in their degree of response. As is obvious from the plot, neither the slope nor the intercept for the regression were statistically significant. The P-value for the coefficient was 0.7811.

Figure 4.4.11 -- SASS Private School Component: Differential Response Rate Effect, Elementary Schools versus Secondary Schools, by Cluster.

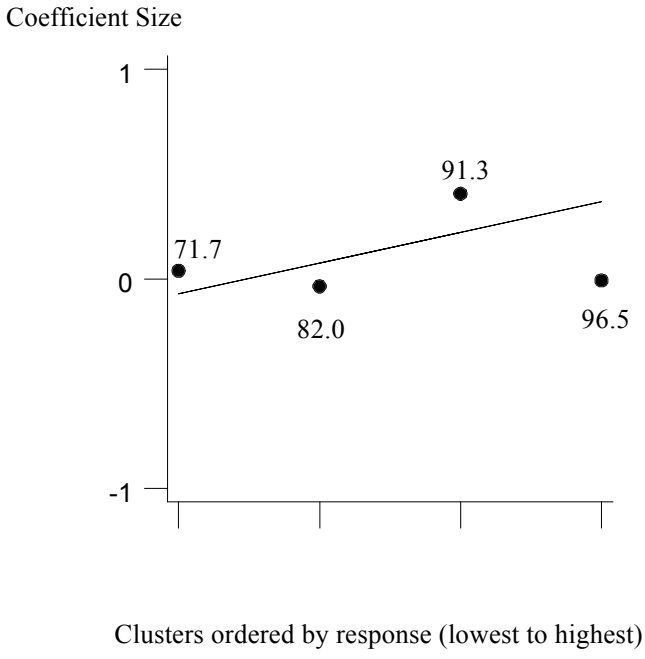


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.2. The corresponding rates are 71.1% for group 1; 96.5% for group 2; 82.0% for group 3; and 91.3% for group 4.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

Figure 4.4.12 shows numerically large relative change in response rates as the clusters increase in their level of nonresponse. These changes, although, are not statistically significantly, as the associations increase in their degree of response. For the sake of completeness, the P-value for the slope coefficient was 0.4119, suggesting that despite the visual appearance of an increase there may be no trend in these data by cluster.

Figure 4.4.12 -- SASS Private School Component: Differential Response Rate Effect, Enrollment 1 to 149 versus Enrollment of 750 or more, by Cluster.

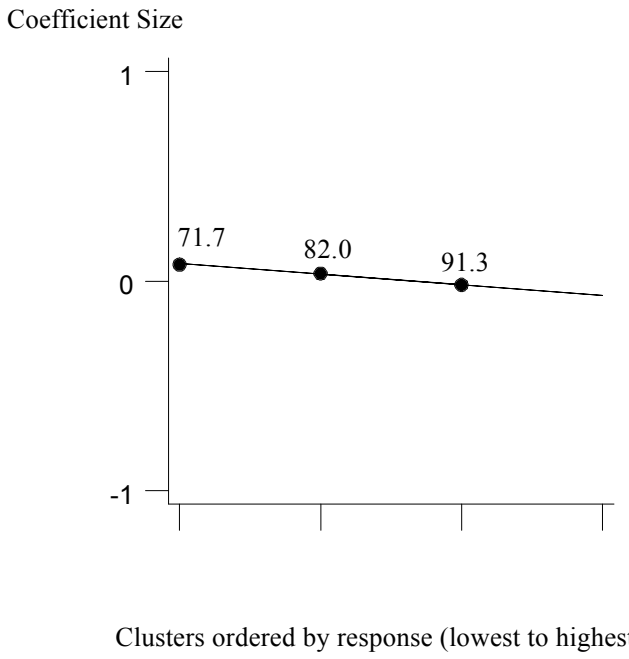


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.2. The corresponding rates are 71.1% for group 1; 96.5% for group 2; 82.0% for group 3; and 91.3% for group 4.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

Figure 4.4.13 shows a marked downward trend in relative response rates as the clusters increase in their level of response. Schools with enrollment 150 to 499 have response rates relative to schools with enrollment of 750 or more that increase significantly, as the associations increase in their degree of response. The P-value for the slope coefficient was 0.0478.

Figure 4.4.13 -- SASS Private School Component: Differential Response Rate Effect, Enrollment of 150 to 499 versus Enrollment of 750 or more, by Cluster.

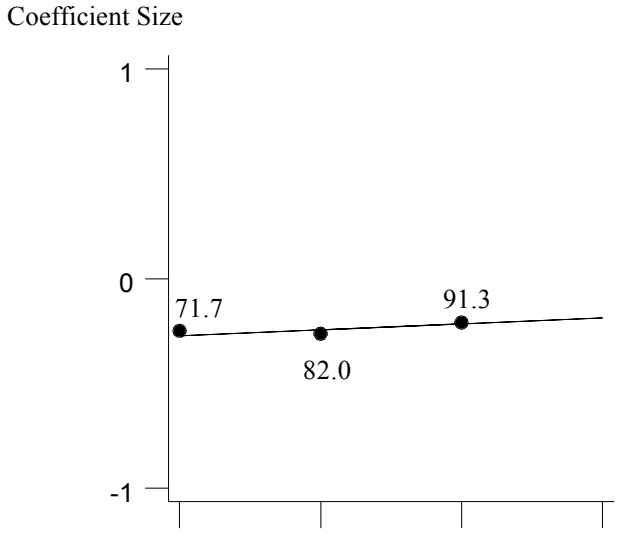


NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.2. The corresponding rates are 71.1% for group 1; 96.5% for group 2; 82.0% for group 3; and 91.3% for group 4.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

Figure 4.4.14 shows a monotonic increase in relative response rates as the clusters increase in their level of response. Schools with enrollment 500 to 749 have response rates relative to schools with enrollment of 750 or more that grow as the associations increase in their degree of response. The P-value is 0.3948. This is so despite the very high values for conventional fit statistics. The adjusted R^2 value, for example, is 0.3246 -- quite respectable, with the unadjusted R^2 value being 0.6623.

Figure 4.4.14 -- SASS Private School Component: Differential Response Rate Effect, Enrollment 500 to 749 versus Enrollment of 750 or more, by Cluster.



NOTE: While the coefficient have been plotted by size, the points have been labeled with overall cluster response rates (in percent) as shown in table 4.4.2. The corresponding rates are 71.1% for group 1; 96.5% for group 2; 82.0% for group 3; and 91.3% for group 4.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Private School Questionnaires).

4.4.3 Summary of Cluster Effects Analysis

Despite the hope that homogeneous groups would allow the frame variables to reveal their strength better, this did not really happen. One reason is that the shrinkage in sample size that occurred as the data were clustered appears to have increased the variance at a greater rate, for most clusters, that the advantage of greater within cluster homogeneity.

Does that mean that the clustering work was wasted? Arguably not, since it is a lot clearer now where urbanicity makes a difference to public school response -- in all states not just those with very high response rates to begin with. Also, it is clearer now why urbanicity for private schools is not important overall. Apparently, it has a different relationship to response rates depending on whether the state is a high or a low response state.[128] Which of these two factors is the cause and which is the effect, of course, remain to be determined.

4.5 "Final" Fitted Model

In this Section, the "final" fitted model is looked at from a national perspective. This is a model of the form --

$$g(x) = b_0 + \sum_{i=1}^{2} b_{1i}\, x_{1i} + \sum_{j=1}^{2} b_{2j}\, x_{2j} + \sum_{k=1}^{3} b_{3k}\, x_{3k} + \sum_{g=1}^{4} b_{4g}\, x_{4g}$$

where all the terms are defined as before. Notice that the frame and cluster variables are all in the model additively.[129]

Attention shifts here to the values of the coefficients for each of the frame variables rather than how best to decide on which states/associations go in what clusters. Much of what was discussed earlier in this Chapter is confirmed.

As can be seen from table 4.5.1, the introduction of clusters of states/associations has generally increased the significance of the effects commented on earlier. For example, both urbanicity coefficients are statistically significant for the public school sample. School level continues to be important for private schools but probably not for public ones. No marked pattern exists by enrollment size, although the effect for schools from 150 to 499 students is significant at the $\alpha = .10$ level but not at $\alpha = .05$. The significance of the effect for small private schools has disappeared; (it got absorbed into one of the clustering effects, perhaps because of its association[130] specific nature).

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[128] Ranging from, say, a significant positive effect for suburban schools in low response associations (group 1) to a slight, but not significantly negative effect for high response associations, (like those in group 2).

[129] Appendix A actually derives one of the models discussed here, that for public schools. The approach has , however, already been discussed at length in Section 4.3 and looked at cluster-by-cluster in Section 4.4.

[130] Recall again from chapter 3, that it was the small schools in the rural South that seemed principally responsible for the overall falloff for private schools with 1 to 149 students (see Table 3.9.5). These two formulations appear linked.

The measures of fit are now quite acceptable, unlike earlier.[131] The best way, though, to see the value of the "final" model is to look, not at the coefficients as in table 4.5.1 or even the measure of fit; but to compare the "final" fitted response rates by state/association to the actuals. This is possible by examining Appendix B tables B.22 (actual) and B.28 (fitted) for public schools or B.29 (actual) and table B.35 (fitted) for private schools.[132]

A few highlights from this comparison are given below. First, most states/associations have overall fitted response rates that are within about one percentage point of their corresponding actuals. This is an excellent outcome but still lacking in some respects. For example, there are a few states (e.g., like Maryland) for which the fitted values are too high and by a considerable amount -- 80.99 percent actual versus 86.07 percent fitted. Conversely, states with nearly perfect response tended to be underestimated. At the region level, though, the results are quite good. For private schools, the patterns are similar as for public schools -- very good for the most part; but with some associations not really particularly close. For example, for American Association of Christian schools, the actual response rate was 59.03 percent, while the fitted rate was 67.93 percent.

Depending on what aspectof SASS an analyst is working on, the fitted values could be quite acceptable. For detailed state/association data, though, they cannot be recommended for states/associations on the extremes -- with very high or very low response rates.

Based on this analysis, it is clear why the word "final" has been put in quotes. More study of response rate patterns, especially with additional variables would be needed to assure an entirely satisfactory fit, if that is even possible.

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[131] The fit measures for the seven SASS component models built on the clusters are as follows: for the Teacher Demand and Shortage component, 71% -- up from virtually nil in the initial national model; for the Public Administrator component, 76% -- up from 20%; for the Private Administrator component, 83% -- up from 25%; for the Private Schools component, as shown in table 4.5.1, about 94% -- up from 27%; for the Public School component, about 87% -- up from 20%; for the Public Teacher component, roughly 91% -- up from 24% initially; and finally, for the Private Teacher component, about 97% -- up from just 23%.

[132] Fitted basic tables are available in Appendix B for all "Final" models, even though only two of these have been discussed in the main body of the report. To look at the actual versus "Final" model predictions compare Appendix B, Tables B.1 and B.7 for TDS; Tables B.8 and B.14 for Public Administrator; Tables B.15 and B.21 for Private Administrator; Tables B.22 and B.28 for Public School; Tables B.29 and B.35 for Private School; Tables B.36 and B.38 for Public Teacher; and Tables B.39 and B.41 for Private Teacher.

Table 4.5.1 -- "Final" overall response model coefficients for SASS public and private school surveys

(Standard errors shown below coefficients in parentheses)

Effect	Public	Private
Reference Group*	-3.1473**	-2.0278**
	(.3331)	(.5037)
Urbanicity		
Rural v. Central City	+.6507**	-.06050
	(.1726)	(.2035)
Suburban v. Central City	+.7636**	+.2670
	(.1715)	(.1846)
School Level		
Combined v. Secondary	-.2983	-.4279**
	(.2817)	(.1646)
Elementary v. Secondary	-.3523	-.8548**
	(.3027)	(.3363)
School Size		
1 to 149 v. 750 or More	-.4120	-.1840
	(.2723)	(.4752)
150 to 499 v. 750 or More	-.3678**	-.0979
	(.1957)	(.4748)
500 to 749 v. 750 or More	-.1796	+.4718
	(.2072)	(.5272)
Cluster		
Group 1 vs Reference Group	+1.2992**	+1.4098**
	(.1733)	(.2063)
Group 2 vs Reference Group	+.9790**	-.8528**
	(.2819)	(.4959)
Group 3 vs Reference Group	-1.2599**	+.6124**
	(.4796)	(.2170)
Group 4 vs Reference Group	+.7205**	n/a
	(.2019)	n/a
Degree of Fit	86.8%	93.5%
Response Rate	95.3%	84.0%

* Secondary schools, with 750 or more students, in central cities, from one of the states/associations included as group 5 (Public) or group 4 (private). Response rates are based on weighted data taken from Chapter 3.
** Statistically significantly different from zero at the α=0.10 level (i.e., the 90% confidence interval does not contain zero).

NOTE: Degree of fit measures were obtained as described in text. Groups are defined in tables 4.3.2 and 4.3.3.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public and Private School Questionnaires).

4.6 Summary

This chapter presented a number of mathematical models to explore the relationships found earlier in the descriptive analyses. The bottom line is that what was learned in Chapter 3 stood up to the more rigorous statistical treatment here.

The exploratory nature of the analysis done began with a simple model of the frame variables at the national level. For various reasons, partly computational, directly modeling state/association as an additional variable was not seen as feasible.[133] Instead, a clustering model was developed that captured most of the state/association variability in response. Arguably, this "final" model may be satisfactory, at least in an initial study.

The problem with the clusters is that it is highly unlikely that they would work well if used on another occasion, say, for the 1993-94 SASS.[134] What is needed, if this modeling were done again, is a feasible computational method to use the states/associations directly.[135] One visual approach that might be tried is to separately fit each state/association to the frame model, as was done in Section 4.4 by cluster; and, then, to plot the coefficients by state/association, ordering them by overall state/association response rate. A standard (weighted) regression or maybe a median trace[136] might be enough to get the sense of the detailed impact of these frame variables across states/associations of very different response rates.

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[133] The resulting table is too big to do in SAS, so various stopgaps were tried. In hindsight, custom programming might have been the best approach.

[134] The 1990-91 clusters were formed stochastically based on response rate differences that are likely to vary from one wave of SASS to another. Therefore, while it would be possible to do the state/association clustering in later SASS rounds (say for 1993-94) the number and composition of the clusters almost certainly would vary from those obtained with the 1990-91 SASS.

[135] Earlier in this chapter the computational problem was mentioned of modeling all the needed variables simultaneously. Conceptually it might have been desirable, for example, to begin by looking say at all public sector components (except TDS). This would mean a table of 3 (components) by 3 (urbanicities) by 3 (school levels) by 4 (sizes of enrollment) by 51 (states and the District of Columbia) by 2 (response outcomes). Or over 11,000 possible combinations. SAS has limitations in such cases and custom programming should have been considered or another method tried.

[136] To do a median trace, it would be necessary to group the states to some degree but not as severely as was done in the clustering algorithm described here and in Appendix A. Just sorting the rows of the basic tables (See Appendix B) to order the states/associations by overall response might be enough to see the shape of the problem. This last idea is so "low budget" that it could be employed as part of the check-in of each SASS round, as it is completed. Suppose to be specific that the national model of section 4.2 were fit for each state. Further suppose that a scatterplot, coefficient by coefficient, was created where the Y variable was a particular coefficient and the X variable the overall state response rate. In the 1990-91 SASS, at least, trying to fit such a scatterplot by a single model did not work. The states had to be grouped into clusters. Employing a local smoothing method, like a median trace, might be highly instructive and perhaps could be made routine. Identifying outliers from the trend might be an excellent quality control/improvement procedure. One way to do a median trace might be to employ a moving window of, say 5 points, take the median for the first 5 states. Then move the window slightly to add one new state and drop one old, recalculate the median each time. Potentially, except for the worst 3 or 4 states this approach might be very worthwhile as a graphical display device to understand the factors contributing to response differences. Of course, the simple trending regression approach used in section 4.4 might also work well.

The biggest problem is that the frame variables are not very related to response. If this study were to be undertaken again, better (more predictive) variables would be needed. Here more use of the CCD/PSS might make sense. Alternatively, for cases that fail to respond after, say, two follow-ups, a "short-form" to collect some predictive information might be appropriate for use in a later nonresponse adjustment.

One final remark. The model specification decisions made in this chapter have been compared with each other; obviously still other model formulations exist. Those by Shen, Parmer, and Tan (1992) deserve special note.[137] These authors used essentially the same 1990-91 SASS data employed here. A Bayesian inference setting was chosen, though, and the actual model coefficients being fit varied too. Their conclusions are quoted below:

> In summary, the variation of response rate for public schools is much smaller than for private schools. For public schools, the nonresponse adjustment cells currently used the U.S. Bureau of the Census are state by grade by level by enrollment by urbanicity. Based on the results of our testing, it seems to be a good choice. When further collapsing is necessary, cells can be collapsed with grade level first, enrollment second and urbanicity third. For the private list frame, the nonresponse adjustment cells currently used by the U.S. Bureau of the Census are association by grade level by urbanicity. Based on the results of testing, we indicated that enrollment may also be a good candidate for creating nonresponse adjustment cells. If further collapsing is necessary, the cells can be collapsed with enrollment first, grade level second, urbanicity third and association fourth.

Their results, obviously, have points of similarity with those in the present report. For instance the SASS public school nonresponse adjustment advice would be the same. This is not the case, though, in the SASS private school component. Table 4.5.1 suggests a different adjustment order with school (or grade) level being collapsed after urbanicity, not before.

[137] Shen, P., Parmer, R., and Tan, A. (1992). "Characteristics of Nonrespondents in the Schools and Staffing Surveys' School Sample." Proceedings of the Section on Survey Research Methods, American Statistical Association. Alexandria, VA: American Statistical Association.

Chapter 5 Conclusions and Recommendations

5.1 Introduction and Highlights

This Chapter summarizes the exploratory findings about SASS response patterns included in the present report. Some of the observations here grow out of the data analyzed from the 1990-91 round of SASS; others came from looking at the survey's documentation. A few even came from comparisons between SASS and similar surveys done elsewhere (often also at the U.S. Bureau of the Census).

Organizationally, the Chapter is divided into six parts, beginning with this short introduction (Section 5.1). Next, in Section 5.2, comes a brief summary of a few suggestions on ways to improve response rates. Ideas about measuring and better documenting response rates make up Section 5.3. In Section 5.4, SASS response adjustments are discussed. Section 5.5 comments on analysis implications of the response patterns found. Possibilities for future study are addressed very briefly in the last section (Section 5.6).

To set the stage for what is to come, it might be worth revisiting the original reasons given for studying nonresponse that were set out in Chapter 1. These are put in the form of questions, followed by brief answers, elaborated on later in the Chapter.

Specifically, for SASS, what were the weak points in survey operations and how can each of the component surveys be improved?

The operation of SASS is of the highest caliber; but some ways to improve it are suggested. Notable among these is the notion that SASS begin a methods test program to keep abreast of the changing nature of school reporting issues.[138] More study of certain anomalies in the 1990-91 data collection could prove valuable too. One example would be the large difference between the response rates of private schools and private school administrators.

Consideration should be given to at least a small subsample of nonrespondents. Doing more intensive follow-up may be worth attempting, including going to the school, in some cases, to complete the forms needed. Experimenting with a restructured questionnaire, perhaps relying more directly on administrative data[139], might help reduce perceived respondent burden as well.

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[138] This idea is sketched in Scheuren, F. (1995) op. cit. That paper mentions many aspects of the school universe which are changing and as SASS lengthens the interval between rounds a method for avoiding surprises needs to be found. Also a test program would allow for a smoother introduction of improvements and might well serve in helping make estimates between SASS rounds. See also Smith, W., Gosh, D., and Chang, M. (1995). "Optimal Periodicity of a Survey: Alternatives Under Cost and Policy Constraints." Proceedings of the Section on Survey Research Methods, American Statistical Association. Alexandria, VA: American Statistical Association.

[139] Again this idea is developed in Scheuren, F. (1995). op. cit. Admittedly it is fraught with difficulties, however, because of timing delays and quality problems. See, for example, Salvucci, S., Bhalla, S., Chang, M., and Sietsema, J. (1995). "Assessing Quality of CCD Data Using a School-based Sample Survey." Proceedings of the Section on Survey Research Methods, American Statistical Association. Alexandria, VA: American Statistical Association.

What information on SASS nonresponse can be used to adjust survey estimates? How much of this "repair work" can be based reliably on the population already sampled?

SASS makes extensive use of key frame variables in adjusting for the existing nonresponse. Other frame variables might also prove of value too and should be tried after their quality has been assessed. The need for more timely data from CCD at the survey adjustment stage seems extremely important, even if the variables currently used to adjust cannot be enriched. If more timely CCD information were available, then a "hybrid" approach to adjustment could be of value using the current approach for most schools, but with perhaps the largest schools being given more individual attention.[140]

How successful was SASS in reaching the various populations it is intended to cover?

The 1990-91 SASS was highly successful in reaching the main populations of interest. There were some weak areas, though. Two examples might be small private religious schools in the South and large public schools in the Northeast. Still, all in all, the survey has enjoyed wide acceptance and considerable success. An ongoing methods study is needed, however, to dig deeper into the soft spots and help keep more from developing. For example, one concern that needs study is how well the survey adjustments compensate for nonresponse among schools serving a high percentage minority student population.

How do SASS nonrespondents differ from respondents? Of the host of traits which set these groups apart, which are those that are primarily responsible for nonresponse?

The present study provided many insights into these questions; but, because of the limited number of variables available for analysis, at best only partial answers were possible. SASS documentation of the reasons for nonresponse could have been better used and more complete.[141] As already noted, it would be desirable to strengthen the CCD information available on the sampling frame at the time of the selection. This could have allowed a better targeting of sample cases to areas of higher than average nonresponse and might also have improved sample estimation in other ways, allowing for some savings in total sample size.

Do SASS nonrespondents differ from respondents in

[140] By a "hybrid" approach is meant to use a mixture of ideas now employed in census household surveys (like post-stratification) in combination with nonresponse techniques from business surveys. See Li, B. and Scheuren F. (1996) op. cit. for more discussion. See also Kaufman, S. and Scheuren, F. (forthcoming), "Estimation in the Schools and Staffing Survey." A paper to be presented at the 1996 American Statistical Association meetings.

[141] This concern is already being addressed in future SASS efforts, see, for example Fink, S., Saba, M., Chang M., and Peng, S. (1995). "Documentation of Nonresponse and Consistency of Data Categorization Across NCES Surveys." Proceedings of the Section on Survey Research Methods, American Statistical Association. Alexandria, VA: American Statistical Association.

ways that affect important survey outcomes?

Little direct information exists on this question and not much more was learned, even after the intensive work done as part of this report. What is an important survey outcome, of course, varies from user to user. An ongoing methods research effort could address this area too -- frankly, though, even then not very much more than in a speculative way. Common sense, especially in view of the very modest success in the predictive modeling done, suggests that bias may be small relative to the variance impact of the nonresponse found, at least for most data estimates. Such a speculation obviously needs monitoring.

5.2 Improving Response

Numerous steps are now taken in SASS to reduce nonresponse. These range from advance letters to several follow-up steps, some by mail and some by phone -- all in an attempt to secure a response. Still more might be done, though. For example, as noted in Chapter 2, the length of the interview could be looked at -- to see if it could be made less burdensome. Some ideas of Dillman have already been tried in the 1993-94 SASS and their effects warrant more study and potential refinement.[142]

An effort may be worth making to change the mode of data collection to fit the respondent. What about the use of FAX (even internet)? What about the use of touch-tone data collection, for example, to get responses to a limited set of questions after, say, two mail follow-ups? Especially for the largest schools? Is there a way to electronically tap into the administrative data of at least some of the sampled schools directly?[143]

As already mentioned, what about having the U.S. Bureau of the Census go to a sample of the nonresponding schools, especially the large ones to try to complete the needed survey schedules? Whatever is done specifically it seems crucial to establish a very small, perhaps even annual, "SASS Methods Survey" that tracks the changing record practices of schools and finds ways to ease the work of responding by fitting the survey vehicle to the respondent.[144] An ongoing experimental program could aid not only in reducing nonresponse but also in understanding what its impact was when nonresponse occurs. If the time between SASS efforts continues to lengthen, then this recommendation becomes all the more crucial.

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[142] For example, Dillman, D., et. al. (1995). op.cit.

[143] This is admittedly a long shot or at least something for the long-term. See Scheuren, F. (1995).op. cit.

[144] For some general ideas on this issue in an organizational survey setting, see Nanapoulos, P. (1995). "Expected Changes in Record Keeping." In International Statistical Institute, ed.,The Future of Statistics, pp. 199-227. Published by the International Statistical Institute.

5.3 Measuring and Documenting Response

The survey practitioners, in their execution of the surveys which make up SASS, focus on unweighted response rates. For analysts, the more appropriate response rates might be weighted. This issue was largely moot for the 1990-91 SASS, since, as seen in Chapter 2, it turns out that these two different ways of looking at response yield similar figures.

A concern that could arise in a future SASS would be what to do if the two response rates deviated to any great extent. Both have a value in planning for the next survey, while the weighted figures are crucial in making resource decisions and adjustments to produce the best estimates possible in the current survey. The 1990-91 SASS nonresponse adjustment procedure nicely reflected this distinction; however, earlier management actions were guided largely by the unweighted response rates.

Typical U.S. Bureau of the Census practice differs in the use of nonresponse information, as between business surveys, like the Annual Survey of Manufactures, where weighted response rates are employed operationally and household surveys, like the Current Population Survey, where they are not.[145] Of course, the inverse of the probability of selection is not the only factor that might be used to weight responders and nonresponders. Weighting, say, by the value of some key variable (e.g., student enrollment in the SASS application), might be used too.[146]

5.4 Response Adjustments

At present, the approach in SASS to the nonresponse adjustment is to form cells that are thought to be homogeneous with respect to characteristics of responding and nonresponding units (schools or administrators or teachers or LEAs). This is fine, as far as it goes, but does not really capture the full information available on the sampling frames being used.

As pointed out in Chapter 2, since SASS is a multi-mode type of data collection (partially a self-administered mail survey, partially an administrative records survey) it could profit from an examination of the nonresponse adjustment methods of U.S. Bureau of the Census establishment surveys which use frame information much more aggressively. The Statistics Canada practice of mass imputation also warrants study, as does the approach being pioneered by Schafer and his colleagues at the National Center of Health Statistics.[147] Ideas from U.S. Bureau of the Census

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[145] For example, as described in the article on the Federal Committee on Statistical Methodology Study of Nonresponse, April 1994, AMSTAT NEWS. See also Shettle, C., Guenther, P., Kasprzyk, D., and Gonzalez, M. (1994). "Investigating Nonresponse in Federal Surveys." Proceedings Section on Survey Research Methods, American Statistical Association Alexandria, VA: American Statistical Association.

[146] Appendix B provides more on the alternatives here.

[147] See the recently published monograph, Cox et al (eds) (1995). Business Survey Methods New York: John Wiley and Sons, Inc. See also Scheuren, F. (1995). op. cit. The basic idea of mass imputation is to statistically match the sample to the entire universe frame, potentially recovering for estimation more of the information on the frame than it was possible to use at the design stage. A good example where a big benefit occurred is found in Wong, W. and Ho, C. (1991). "Bootstrapping Post-stratification and Regression Estimates from a Highly Skewed Distribution." Proceedings of the Section on Survey Research Methods, American Statistical Association. Alexandria VA: American Statistical Association. The potential to reduce variance and bias impacts exist here.

household surveys may also turn out to be worth a look --- notably, the introduction of control totals for the survey year being estimated. Here there are lots of options from better synchronization of CCD and SASS, to only doing SASS in years when the Private School Survey is also conducted.

The analysis done of the private sector SASS components in chapters 3 and 4 focused almost entirely on list sample cases. The area sample cases deserve some discussion, especially in view of their lower than average response rates. One recommendation is to continue the research coverage improvements in the Private School Survey (PSS) frame.[148] This work when combined with the PSS coverage adjustment research of Causey[149] may make it possible to discontinue the SASS area sample altogether. At present, to address the undercoverage of the frame, SASS employs an area sample, and incurs considerable cost and high nonresponse. With the Census Bureau efforts now underway, the PSS may continue to improve and combined with a direct frame coverage adjustment the SASS area samples could be discontinued.[150]

5.5 Analysis Implications of Response Rates

Very broadly, as has been seen, the seven SASS components seem to group into three categories: the Teacher Demand and Shortage (TDS) survey (which is in a class by itself), the three remaining public sector surveys (of schools, administrators, and teachers), and the three private sector surveys (again of schools, administrators, and teachers).

For the TDS survey, the frame variables studied: urbanicity, school level and school size do not differentiate the response rates very well. Unlike the TDS survey, statistically significant differences exist across at least some of these frame variables in both the private sector surveys and among the remaining public sector ones.

For all seven SASS components regional patterns in response are an important consideration for analysis. For the public school surveys, moreover, state-by-state variation in response is sizable. For private sector surveys, the school's association also matters greatly.[151]

SASS cost reductions may also be possible at the data collection stage, especially if the SASS area frame samples are rethought. The PSS area frame would continue to be needed; but it might be possible to discontinue updating and using that for SASS.

[148] For example as described in Jackson, B. and Frazier, R. (1995). "Improving the Coverage of Private and Elementary-secondary Schools." Proceedings of the Section on Survey Research Methods, American Statistical Association. Alexandria VA: American Statistical Association.

[149] Causey, B. (1995). "Undercount Adjustment for Private Schools." A Statistical Research Division seminar. U.S. Bureau of the Census. Causey's undercoverage modeling in PSS may make possible another estimation strategy for SASS. See Kaufman, S. and Scheuren, F. (1996). "Improved Estimation in the Schools and Staffing Survey." A paper to be presented at the Chicago Joint Statistical Meetings. See also Causey, B., Bailey, L., and Hoy, E. (1996). "Alternative Methods of Coverage Estimation for the Private School Survey." A paper to be presented at the Chicago Joint Statistical Meetings.

[150] For more on this see Kaufman, S. and Scheuren, F. (1996). op. cit.

[151] The operational impact of regional, state, and association differences is less clear but could be a factor in SASS sample size determination. Looking at differences by Census Bureau regional office (not done here) might also be instructive. Note there were 12 Census Bureau regional offices at the time of the 1990-91 SASS.

The extensive descriptive and inferential analyses in Chapters 3 and 4 may warrant the following summary of the analysis implications of the nonresponse:

-- First, SASS response rates, as has been seen, are high overall. This is perhaps the best news for the analyst, since elaborate precautions may not be necessary.

-- Second, SASS response rates are not easily summarized, so no quick rules of thumb are available as mnemonics. Grouping the seven components studied helps but only to a limited degree. In reality, the seven SASS components studied are all very different surveys; and, except for the economies of data collection, might best be considered separately.

-- Third, the frame variables examined: urbanicity, school level, and school size were helpful in describing response patterns but often differences were small. Either there really are no strong patterns to see or the right variables were not used. This problem was particularly acute for the TDS survey but occurred elsewhere as well. Variables sought for the analysis but not found usable were some measure of minority enrollment and for teachers, both minority status and items like length of time teaching. The introduction of more frame variables would seem to be essential for any future analysis of SASS response rates.

-- Fourth, and related to the above, the variables looked at were all used in one way or another in the 1990-91 SASS nonresponse adjustment procedures. This means that the effect of any differential response noted here on an intended analysis is greatly mitigated. True, the differentials in response will increase the variance but if the nonrespondents are otherwise "missing at random," there will be no resulting bias.

-- Fifth, what was desired initially, but not possible, was to systematically study at least one other important variable not involved in the nonresponse adjustment. Had this been possible, the issues of nonresponse bias could be covered to some degree.

5.6 Areas for Future Study

The recommendations made in this report, especially in this concluding chapter, call for small ongoing efforts as part of survey operations -- to continue to study nonresponse and to improve its handling operationally. The one big exception is that the SASS system be enlarged to include an annual "Methods Study."

What remains to be said is whether a large-scale study, like that done for this report should be repeated. The simple answer is not any time soon -- unless new variables are available. A modest effort might be tried to apply the insights in this work to the 1993-94 SASS, as a way of testing some of the exploratory analyses undertaken. The scope of that effort, though, should be about what is needed to give a short paper at a professional meeting. Small ongoing monitoring is a better approach; and, until considerable change takes place, there is no need to go into the depth attempted here. Before doing another large study, the survey should evolve; much better explanatory variables would be needed too, and in some places better tools for analysis.

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Appendix A

Modeling Example
Public School Component
1990-91 SASS

This Appendix provides an example of the stepwise clustering procedures discussed in Chapter 4. While similar approaches were taken for all seven SASS components, only the Public School Survey is covered here.

The goal of the analysis was to study the effect of urbanicity, school level, and school size on response rates in the Public School Survey. Given that there was variability in response across states, an additional categorical variable used to group or cluster states was included in the model. The objective of grouping the states was to reduce the variability in response due to the states in order to concentrate on the variation caused by the other frame variables.

As in Chapter 4, the multiple logistic model employed was:

$$g(x) = b_0 + \sum_{i=1}^{2} b_{1i}\, x_{1i} + \sum_{j=1}^{2} b_{2j}\, x_{2j} + \sum_{k=1}^{3} b_{3k}\, x_{3k} + \sum_{g=1}^{4} b_{4g}\, x_{4g}$$

where $P(Y=1|x) = \pi(x)$ is defined as the conditional probability that the outcome is present and

$$\pi(x) = \frac{e^{2g(x)}}{1 + e^{2g(x)}}$$

where x_{1i}, i=1,2, 3 are the "dummy" variables coding urbanicity, x_{2j} j=1,2,3 the "dummy" variables coding school level, x_{3k}, k=1,2,3,4 the "dummy" variables coding school size and x_{4g}, g=1,2,..,4 the "dummy" variables coding state groupings.[A1]

Defining State Clusters. --The "final" state model was selected through a stepwise, modeling procedure which began with a baseline model containing all frame variables and placing all states in one group. The successive models included all frame variables and only differed in how they divided the states into groups. No interactions (the combined effect of two or more variables) were modeled. The fit of each model was assessed by how well it estimated response at the state level. A t-value was calculated for each state, comparing the fitted versus the actual response rate. The formula used is shown below.

$$\frac{\text{Response Rate - Estimated Response Rate}}{\sqrt{(\text{Design Effect})\dfrac{(\text{Response Rate})(1 - \text{Response Rate})}{\text{Sample Size}}}}$$

The design effect used for the Public School Survey was 1.7433. The criterion for segregating states in the successive models was that the t-value be less than -2 or greater than +2.

[A1] The fitting was done by weighting the survey data within state/association. Issues in estimating the b parameters in this way are covered in Pfeffermann, D. (1993), The role of sampling weights when modeling survey data. International Statistical Review, 61(2): 317-337.

These familiar values were chosen to yield nominal two-tail t-tests at the 5 percent significance level.[A2]

In the course of the modeling procedure, plots of observed versus fitted response rates were used to graphically identify outliers. An outlier was either assigned to a state group by itself or to a group of states of comparable response rate already formed in a preceding model. In a very few instances states which did not violate the t-value criterion but appeared to be outliers in the plots were also placed into groups. Therefore, the division of states into groups by this procedure was not unique.

The recursive modeling procedure began by fitting the data to a complete, baseline model which contained all three categorical sampling frame variables and all of the states in one group. If the t-value criterion by state was not violated the modeling procedure was terminated; otherwise the plot of the estimated response rate versus the actual response rate was used to identify outliers, the groups were redefined, a new model was fitted, and the cycle was repeated.

For the Public School survey the modeling process was terminated after the seventh model was fit. In the final model there were 5 state groups, coded with m=4 dummy variables.

Step 1: Fitting the baseline model. --Model 1, the base line model, only used the three demographic variables community type, school size, and school level to determine how well the response could be explained without any State groupings. The plot of response rate vs. estimated response rate (Figure 1a) showed that the District of Columbia (DC), Maryland (MD), New Jersey (NJ), and New York (NY) were all outliers. These States were all well to the right and below the line which indicates that their estimated response rates were all well above their response rates. In fact these States had the lowest response rates, DC at 86.3%, MD at 81.0%, NJ at 88.3%, and NY at 87.6%. The plot of the errors vs. the estimated response rate, figure 1b, shows how poorly this model fits these States. Of all the States DC, MD, NJ, and NY have the greatest errors at over 6%. So these four States were grouped together in model 2.

Step 2: Fit model 2 -- Model 2 had 2 groups: (1) the District of Columbia, Maryland, New Jersey, New York; and (2) all the Remaining States. For this model Alaska (AK) and Massachusetts (MA) appeared to be outliers. (Figure 2a) Their response rates were 92.0% for AK and 91.1% for MA. AK and MA were grouped together for model 3. (See also figures 2b and 2c.)

Step 3: Fit model 3. --Model 3 had 3 groups: (1) the District of Columbia, Maryland, New Jersey, New York; (2) Alaska and Massachusetts; and (3) the Remaining States.
Indiana (IN) had a t-value of 6.41 the largest for this model (figure 3c), and also had the highest response rate at 99.6% (figure 3a). Since IN had an extremely large t-value it was put into a group by itself for model 4 to determine if it may be the cause of the other significant t-values.

[A2] Since an exploratory analysis was being conducted, it was enough to rely basically on a consistent rule to determine which states fell in which clusters. For all the usual multiple comparison reasons, the actual significance values, of course, were considerably greater. See Ahmed, S. (1992) op. cit.

Step 4: Fit model 4. --Model 4 had four groups:(1) the District of Columbia, Maryland, New Jersey, New York; (2) Alaska, Massachusetts; (3) Indiana; and (4) the Remaining States.

Hawaii (HI) and Illinois (IL) both had significant t-values with 3.10 and 2.96 respectively. (Figure 4c) The response rates for these two States was 98.7%. (Figure 4a) Since these two States had significant t-values and high response rates they were put into the group with IN for model 5.

Step 5: Fit model 5. --Model 5 had four groups: (1) the District of Columbia, Maryland, New Jersey, New York; (2) Alaska, Massachusetts; (3) Hawaii, Illinois, Indiana; and (4) the Remaining States.

Connecticut (CT), Delaware (DE), North Carolina (NC), Virginia (VA), and Washington (WA) were all clustered together, well to the right and below the line in figure 5a. The response rates for these States were 93.1% for CT, 93.3% for DE, 92.6% for NC, 92.2% for VA, and 92.6% for WA. None of these States had significant t-values, however since these States clearly stick out they may be part of the cause of the remaining significant t-values. For model 6 these five States will be grouped together.

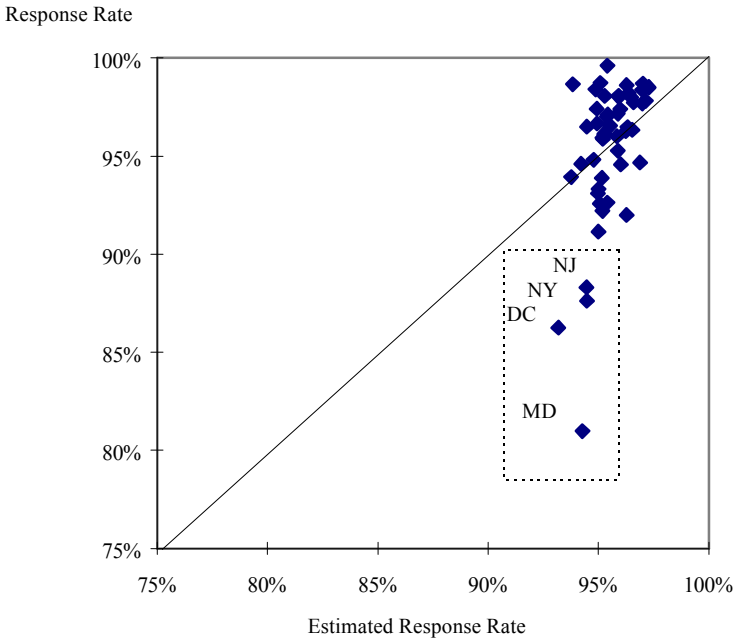
Step 6: Fit model 6 -- Model 6 had 5 groups:(1) the District of Columbia, Maryland, New Jersey, New York; (2) Alaska, Massachusetts; (3) Hawaii, Illinois, Indiana; (4) Connecticut, Delaware, North Carolina, Virginia, Washington; and (5) the Remaining States.

For this model only Utah (UT) had a significant t-value of 2.14. (figure 6c) Since UT had a significant t-value and a high response rate it will be added to the group containing HI, IL, and IN, other States with high response rates, for model 7.

Step 7: The final model. --Model 7 had 5 groups:(1) the District of Columbia, Maryland, New Jersey, New York; (2) Alaska, Massachusetts; (3) Hawaii, Illinois, Indiana, Utah; (4) Connecticut, Delaware, North Carolina, Virginia, Washington; and
(5) the Remaining States.

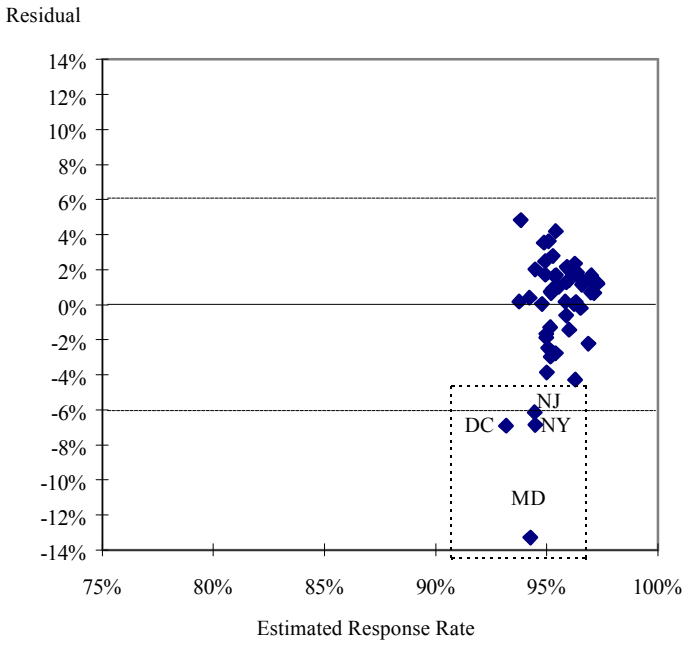
For this model no States had a significant t-value. (Figure A.7c) so the modeling process was terminated. Clearly, though, Maryland might be a cluster by itself -- at least based on the plots (figure A.7b and A.7c).

Figure A.1a: Model 1; 1 Group Model; {ALL STATES}



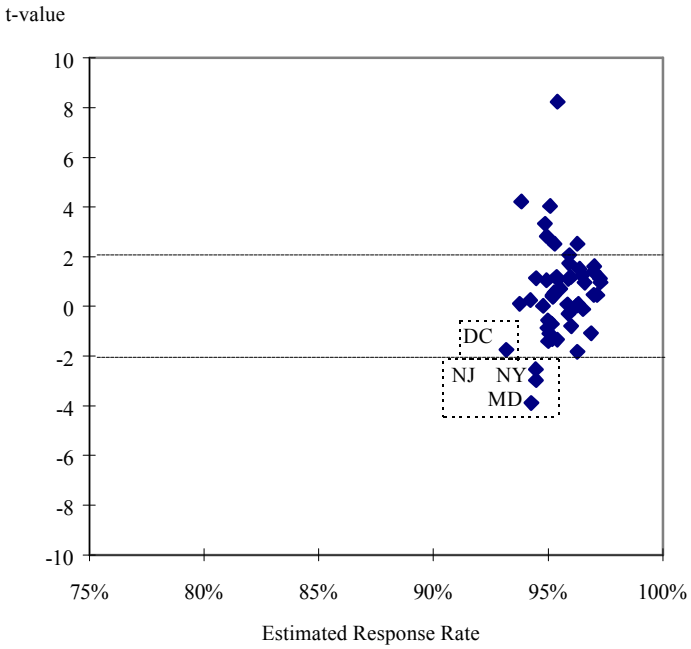
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.1b: Model 1; 1 Group Model; {ALL STATES}



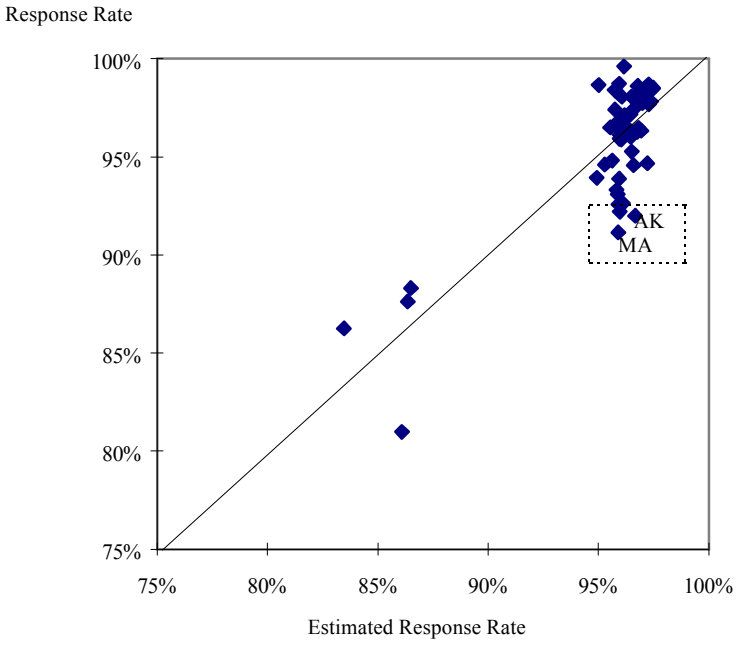
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.1c: Model 1; 1 Group Model; {ALL STATES}



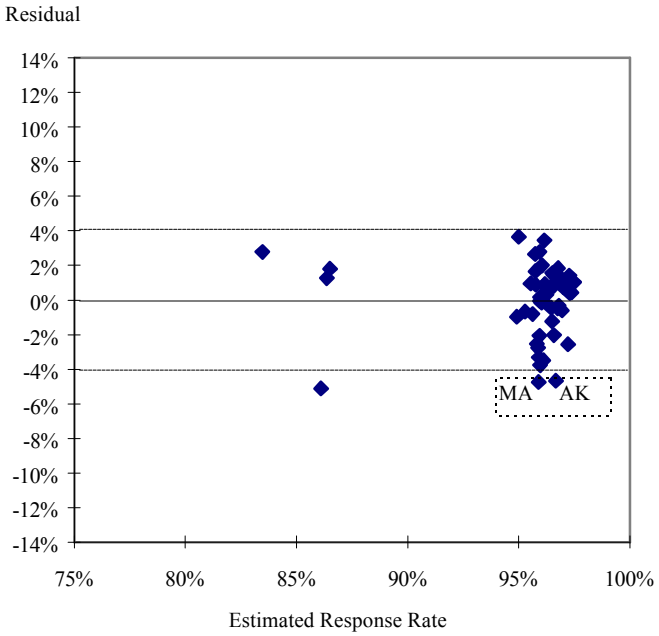
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.2a: Model 2; 2 Group Model; {DC, MD, NJ, NY}, {REMAINING STATES}



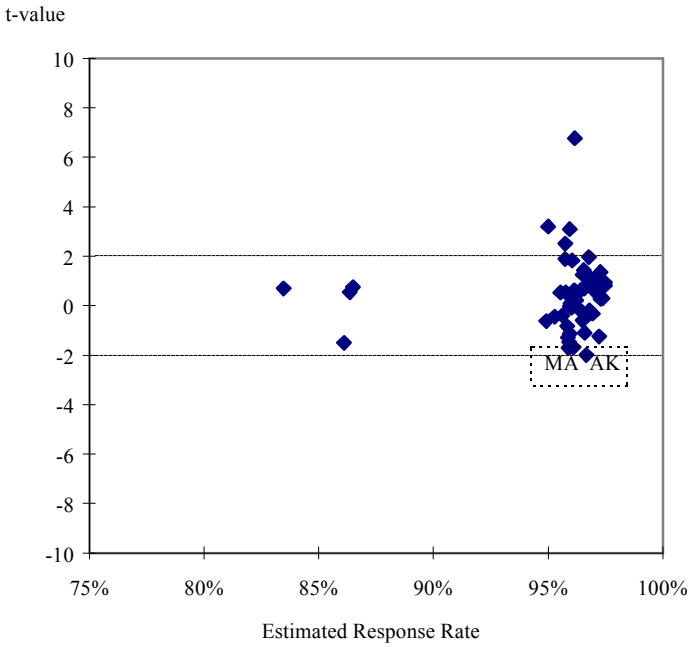
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.2b: Model 2; 2 Group Model; {DC, MD, NJ, NY}, {REMAINING STATES}



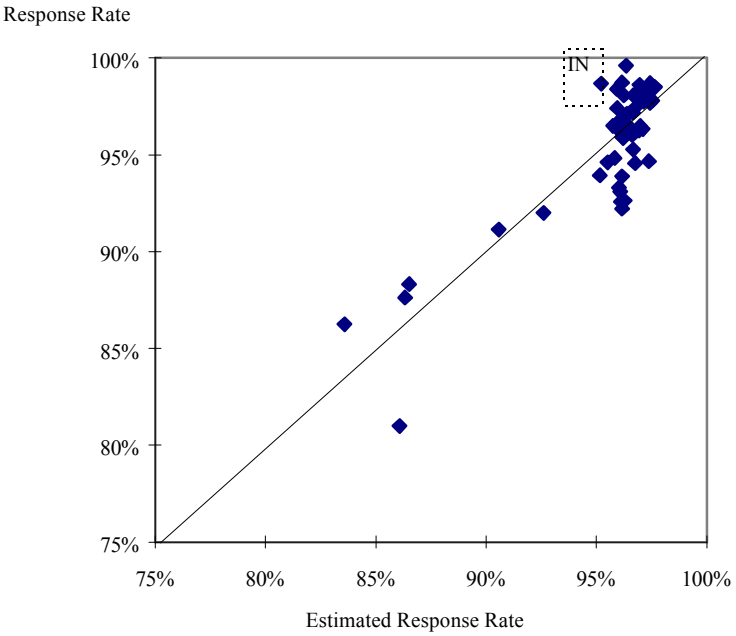
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.2c: Model 2; 2 Group Model; {DC, MD, NJ, NY}, {REMAINING STATES}



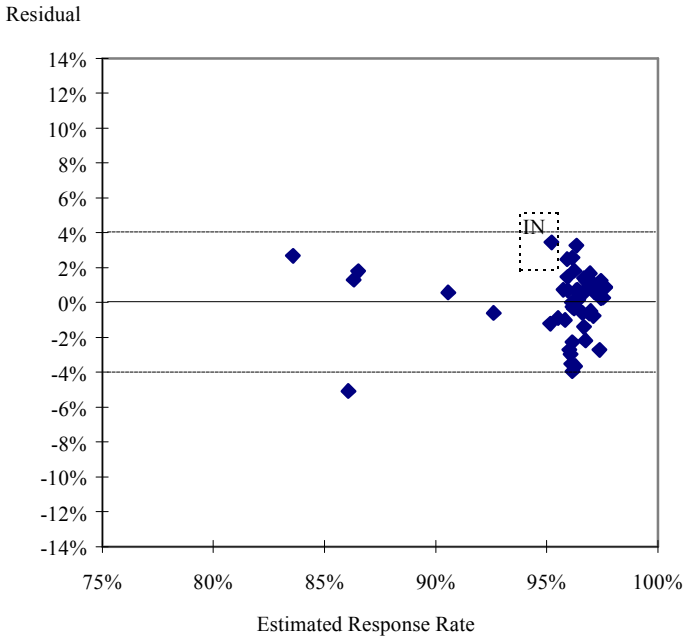
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.3a: Model 3; 3 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {REMAINING STATES}



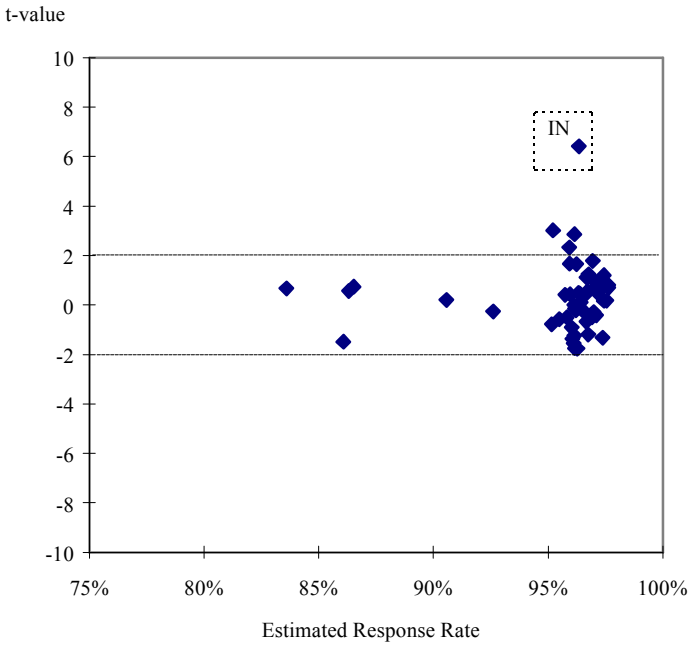
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.3b: Model 3; 3 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {REMAINING STATES}



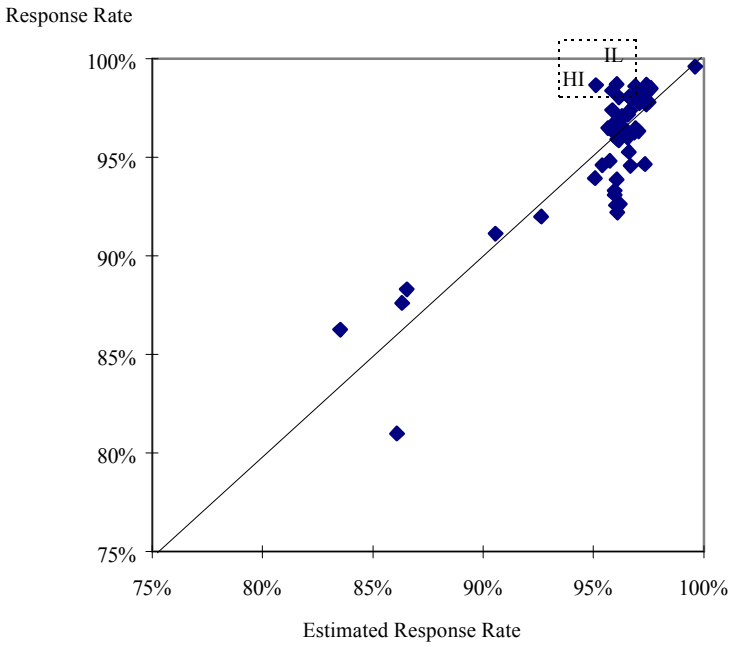
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.3c: Model 3; 3 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {REMAINING STATES}



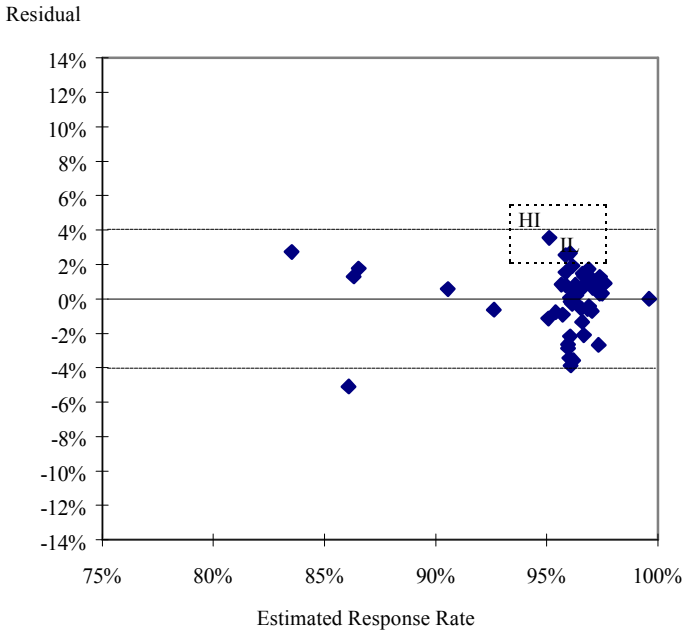
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.4a: Model 4; 4 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {IN}, {REMAINING STATES}



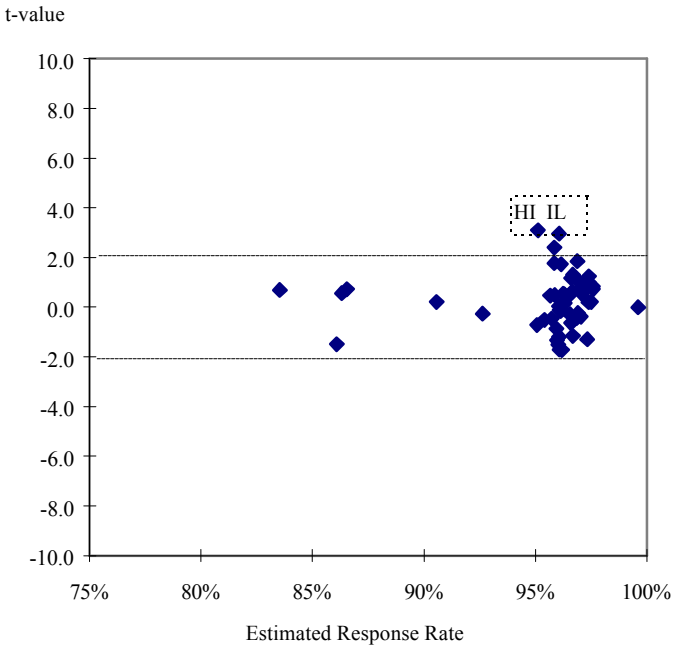
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.4b: Model 4; 4 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {IN}, {REMAINING STATES}



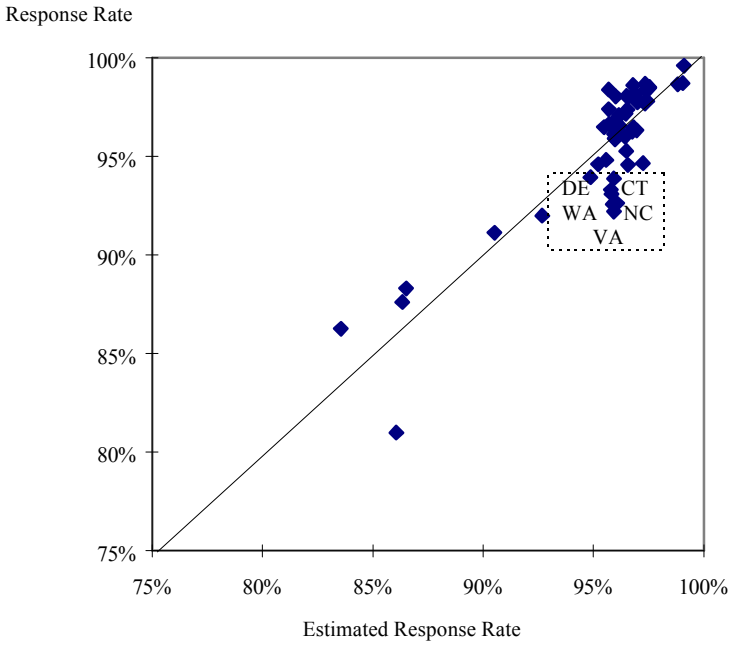
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.4c: Model 4; 4 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {IN}, {REMAINING STATES}



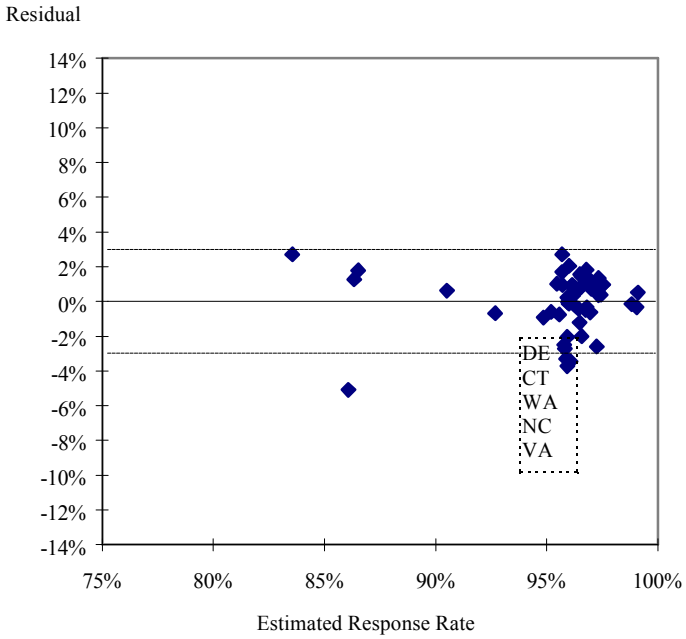
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.5a: Model 5; 4 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {HI, IL, IN}, {REMAINING STATES}



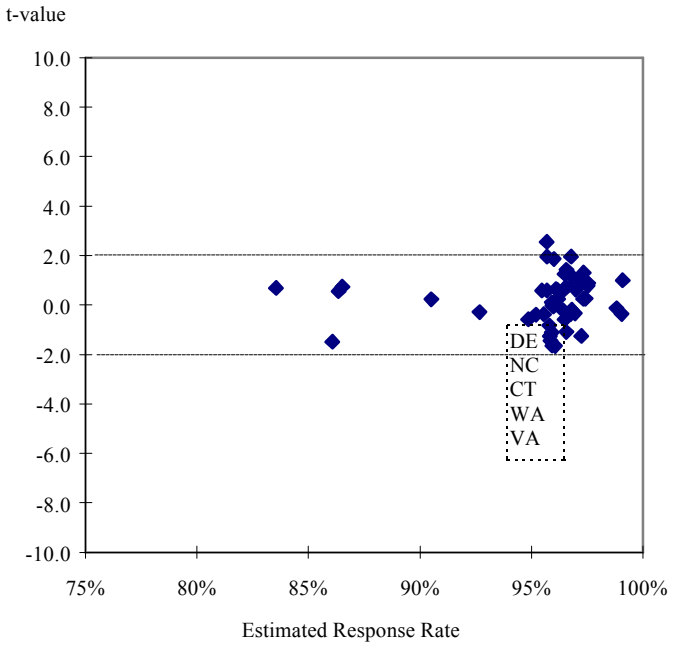
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.5b: Model 5; 4 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {HI, IL, IN}, {REMAINING STATES}



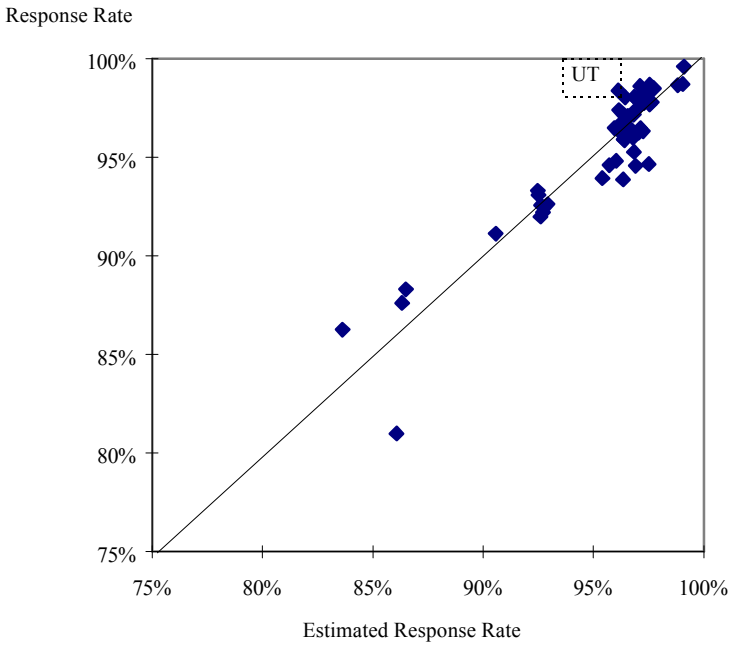
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.5c: Model 5; 4 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {HI, IL, IN}, {REMAINING STATES}



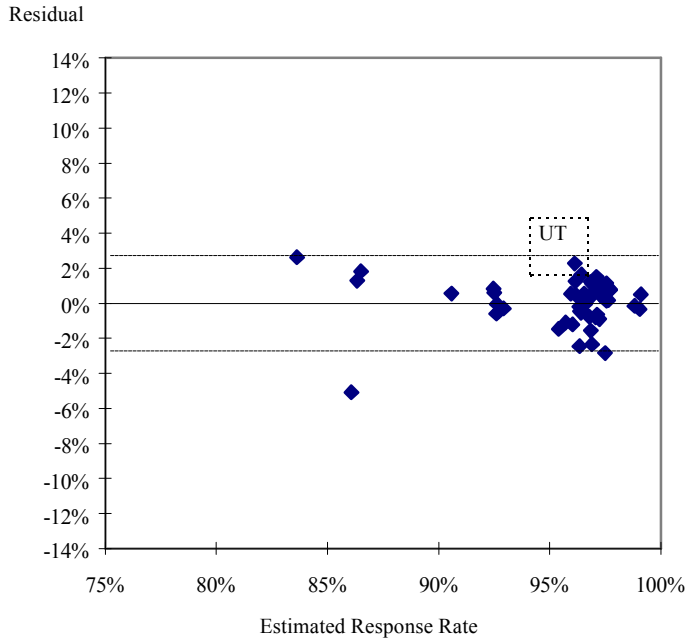
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.6a: Model 6; 5 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {HI, IL, IN}, {CT, DE, NC, VA, WA}, {REMAINING STATES}



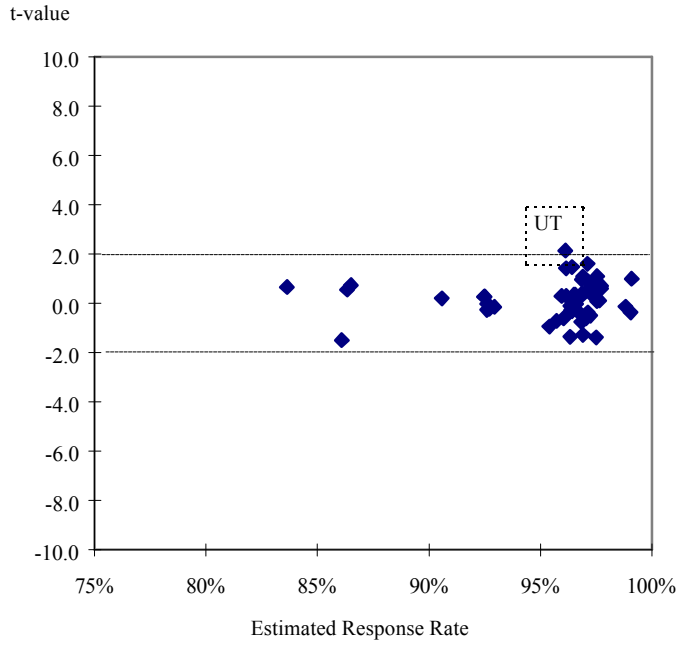
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.6b: Model 6; 5 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {HI, IL, IN}, {CT, DE, NC, VA, WA}, {REMAINING STATES}



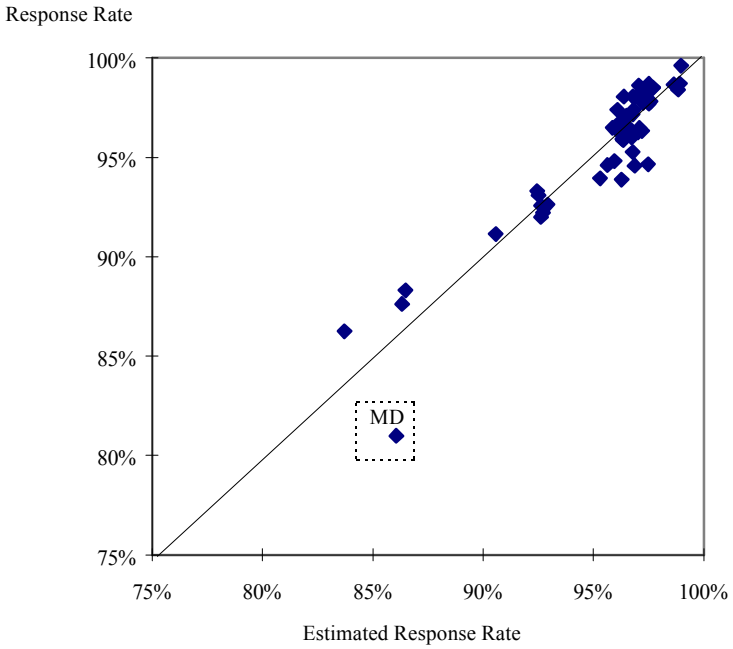
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.6c: Model 6; 5 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {HI, IL, IN}, {CT, DE, NC, VA, WA}, {REMAINING STATES}



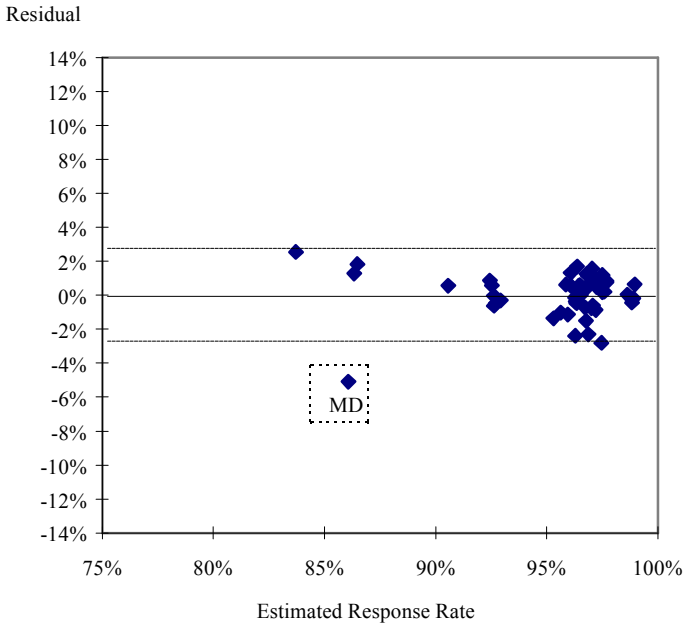
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.7a: Model 7; 5 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {HI, IL, IN, UT}, {CT, DE, NC, VA, WA}, {REMAINING STATES}



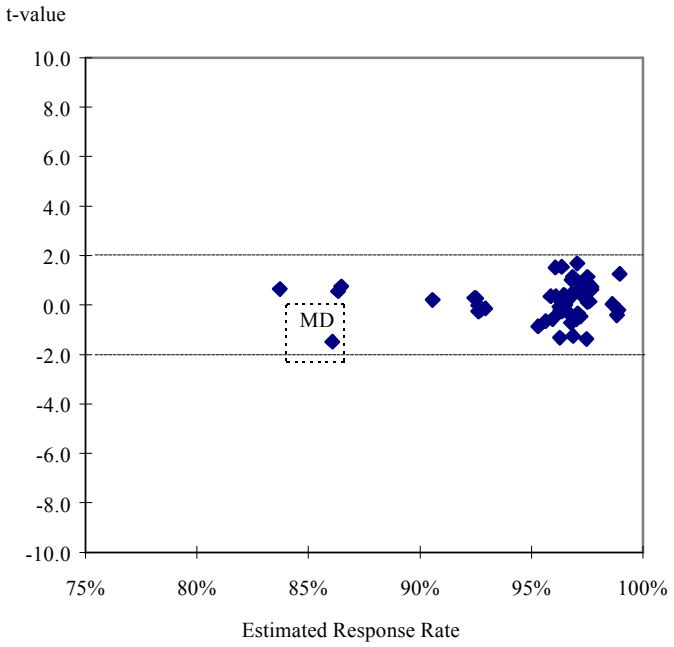
SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.7b: Model 7; 5 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {HI, IL, IN, UT}, {CT, DE, NC, VA, WA}, {REMAINING STATES}



SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Figure A.7c: Model 7; 5 Group Model; {DC, MD, NJ, NY}, {AK, MA}, {HI, IL, IN, UT}, {CT, DE, NC, VA, WA}, {REMAINING STATES}



SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey: 1990-91 (Public School Questionnaires).

Appendix B

Basic Response Rate Tabulations
by
SASS Component

Basic Response Rate Tabulations

In this Appendix, a number of response rate calculations are given to round out the discussions in the main body of the report. Two viewpoints are taken here regarding response:

-- There is a conventional data producer perspective that is based largely on (unweighted) sample-based measures of response.

-- A data user perspective is also given, looking at response rates which have been weighted by the inverses of the probability of the case's selection into the sample.

Alternative Response Rates Calculations

Data producer measures were central to the Report's discussion in Chapter 2. In Chapters 3 and 4, response rates were weighted by the inverses of a case's selection probability. In the main Report, only simple versions of these unweighted and weighted rates were looked at. Here additional variations are examined that are suggested by the hybrid nature of SASS -- since it is both an establishment and a personal interview survey.

To this end, for each component of SASS, six response rates have been calculated[1].Table A on the next page displays the choices made; and how these are designated in the basic tables which follow.

Three are sample-based measures and three are population-based (i.e., weighted by the inverses of the probability of a case's selection). For each type of response calculation, measures of the importance of the response have been given. The most familiar of these is to treat all response as being equal. This is the convention used in the main body of the Report -- either with sample-based unweighted measures, such as those in Chapter 2 or with the population-based weighted measures in Chapters 3 and 4. Two other measures are also provided, but only in this appendix. These are measures that treat responses from larger schools as more important than those from smaller schools. The two values used to quantify size of school were the number of teachers and student enrollment.

[1] Variable ISR (Interview Status Recode) indicates whether the sampling unit is: (1) out-of-scope (e.g., school permanently closed, not a school, no elementary or secondary teachers, teacher retired); (2) interview; (3) noninterview (e.g., refused, unable to contact). The response rates were derived based on this variable and up to five different weights.

Table A. -- Alternative Response Rate Measures for Basic Tabulations.

(Cell entries refer to the designations used in basic tables.)

Measure of Importance of Response	Sample-based Response Rate	Population-based Response Rate
Count Only	NO WEIGHT	BSCWGT
Teacher Total	TCHCOUNT	BSCWGT*TCHCOUNT
Enrollment	STCOUNT	BCSWGT*STCOUNT

Each of the cells in table A is described below and connected to the basic table designations which appear later on in this Appendix.

-- NO WEIGHT: These are completely unweighted response rate tables which were derived by dividing the number of usable questionnaires in each class by the number of eligible cases (the number of sample cases minus out-of-scope cases).

-- TCHCOUNT: These are response rate tables which were derived by adding up the number of teachers in responding units and dividing this quantity by the total number of teachers in all the units in the sample (again excluding cases that were out of scope).

-- STCOUNT: These are response rate tables which were derived by adding up the number of students in responding units and dividing this quantity by the total enrollment in all the units in the sample (again, excluding cases that were out of scope).

-- BSCWGT: These are population weighted response rate tables which were derived by weighting the responding units by the inverse of their sample selection probability; then, dividing this quantity by the total weighted number of cases in the sample (excluding out- of-scopes).

-- BSCWGT*TCHCOUNT: These are population weighted response rate tables which were derived by adding up the weighted number of teachers in responding units and dividing this quantity by the total weighted number of teachers in all the units in the sample (out-of-scopes excluded). The weighting here is the same as in the BSCWGT tables above -- namely the inverse of the probability of selection of the sample case.

-- BSCWGT*STCOUNT: These are weighted response rate tables which were derived by adding up the weighted number of students in responding units and dividing this quantity by the total weighted enrollment in all the units in the sample (excluding out-of-scope cases). The weighting again is the same as in the BSCWGT tables above -- namely the inverse of the probability of selection of the sample case.

The above designations appear in this Appendix for all SASS components, except for the teacher sample.[2] For the Teacher Demand Survey, the units were entire school districts; for the school and school administrator samples the units were sampled schools.

Interpretation of Alternative Response Rates

Differences in response measures can be informative. It was recommended in Chapter 2 that SASS consider using both weighted and unweighted rates during survey operations. While this arguably would not have mattered much for the 1990-91 SASS, it could in a future survey. To illustrate this, it might make sense to compare the different response rates defined here for a particular SASS component, say, the Private School Administrator sample. To do this the same format employed in table B has been used again; this time putting the actual rates calculated in the cells for each approach.

Notice how close some, but not all of these measures are to each other. At the national level, it seems implausible that different management decisions would be made based on the data shown. The differences in rates do indicate, though, that response was

Table B -- Alternative Response Rate Measures for Public School Sample.

(Cell entries refer to the designations used in basic tables.)

Measure of Importance of Response	Sample-based Response Rate	Population-based Response Rate
Count Only	95.07	95.30
Teacher Total	93.59	94.21
Enrollment	93.99	94.31

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Surveys: 1990-91 (Public School Questionnaires).

better for larger schools; or, conversely relatively poorer for small schools. At a regional level, however, there are differences big enough to look into and potentially to intervene during survey execution. From basic tables B.15 to B.20, for example, the response rates vary across measures by over 7 percentage points. Table C below displays these. SASS tables, like Table C, might be produced by Census Bureau regional office in future surveys as a response rate monitoring device.

[2] For the teacher samples, only two basic tables are shown. These are without any weights (NO WEIGHT) and with an adjusted teacher weight (ADJWGT), that is comparable to the BSCWGT concept used elsewhere.

Table C -- Regional Response Rates by Method of Calculation by Region for the Public School Sample.

Alternative Method of Calculation	Midwest	Northeast	South	West
NO WEIGHT	97.03	92.21	94.64	95.63
TCHCOUNT	96.00	90.22	93.52	94.45
STCOUNT	95.75	90.97	93.53	95.37
BSCWGT	97.64	91.59	95.24	95.14
BSCWGT*TCHCOUNT	96.97	89.91	94.53	94.60
BCSWGT*STCOUNT	96.84	90.02	94.48	94.74

SOURCE: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Surveys: 1990-91 (Public School Questionnaires).