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Working Paper Series

Geographic Variations in Public Schools' Costs

Working Paper No. 98-04 February 1998

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Foreword

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Geographic Variations in

Public Schools' Costs

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National Center for Education Statistics

February 1998

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Executive Summary

The desire to understand the patterns of variation in educational services across geographic regions of the United States has increased the need for meaningful and reliable measures of the patterns of educational cost differences. Measuring these patterns of variation, however, is not a simple undertaking. To account for these variations, it is necessary to adjust the *actual* values of expenditures that are commonly reported by public school systems in order to determine the *real* (or cost-adjusted) differences in educational services across geographic jurisdictions.[1] What is needed is a geographic cost-of-education index to measure variations in the prices of school inputs (personnel and nonpersonnel items used in the provision of school services) across geographic locations in the United States.

Specifically, a geographical cost-of-education index (hereafter referred to as GCEI) would measure how much more or less it costs to provide the same quantities and qualities of school resources and services in different locations. The GCEI reflects that portion of the variation in educational spending that is due to factors beyond the control of local school decisionmakers—that is, variations in the cost of living and the attractiveness of the school districts and regions within which school personnel work and live. Such an index would be useful for comparing educational expenditures across states or local jurisdictions, and would provide important information to policy makers and educators who are increasingly interested in measuring the variations in the *real* (or cost-adjusted) level of investment in education across states.

Purpose

The analyses presented in this report address the following question: *How much more or less does it cost to provide the same levels of educational resources across different geographic locations in the United States?* To answer this question, the report develops a comprehensive geographic cost-of-education index for school services and resources that focuses on the prices of the inputs (personnel and nonpersonnel items used in the provision of school services) purchased by schools. The approach offered in this report is unique. It builds on previous work by Chambers (1995b) in which the NCES *Schools and Staffing Survey (SASS)* for 1990-91 is used to develop a teacher cost index. The report goes beyond this 1995 study to make several significant contributions:[2]

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[1] The term *actual* refers to the values of expenditures reported by school districts or state agencies. The term *real* (or *cost-adjusted*) refers to measures that have been adjusted by dividing the actual values by a cost index—in this case, the geographic cost-of-education index—so that comparisons may be made between figures from different time points.

[2] Another contribution of this research is that the methodology can be used to measure inflation in the prices of school inputs. For a further discussion of this application of the hedonic wage model, the reader is referred to Chambers (1997-II).

- ***Improvements in explanatory measures***[3]**.** The present analysis improves upon the previous work by incorporating additional measures of teacher quality (for example, quality of the undergraduate college attended), exploring alternative ways of measuring teacher experience, including more accurate data on local crime rates, controlling for the effects of collective bargaining, and using a more sophisticated measure of labor market competitiveness—the Herfindahl index.[4]

- ***Extension to additional school inputs.*** This report takes a significant step toward developing a comprehensive, nationwide geographic cost index by developing separate school input price indices for school administrators, selected categories of noncertificated school personnel, and specific categories of nonpersonnel inputs. Data derived from the public school administrator questionnaires of the NCES *Schools and Staffing Survey (SASS)* are used to estimate hedonic salary equations in much the same way as was done for teachers' salaries earlier (Chambers, 1995). The hedonic wage methodology was also applied to selected samples of individuals who hold jobs similar to those of noncertificated school personnel throughout the United States (derived from the *Current Population Surveys).*[5]

- ***Application to expenditure data.*** The *GCEI* is applied to state-level expenditure data to illustrate how such an index might be used to adjust actual expenditure data reported by NCES. Using the *GCEI* developed for the three sample years included in the *SASS* data, analysis of the patterns of *actual* and *real* (cost adjusted) school spending across geographic regions of the United States are presented.

Further, the GCEI developed in this report focuses directly on school inputs and attempts to adjust for the qualitative differences in those inputs employed across geographic locations. The index controls for variations in a wide range of personal and job characteristics that affect the supply of, and demand for, school personnel. It reflects differences across geographic locations in factors that underlie cost-of-living differences and differences in the characteristics of regions that affect their desirability as places to live and work. In addition, the methodology reduces the influence of forces within the control of school decisionmakers by including in the GCEI estimates only those factors that are beyond local control. Finally, the geographic cost adjustments contribute to the school finance policy debate by improving how the NCES can report fiscal information across geographic locations within the nation, enhancing an understanding of factors that affect changes in the patterns of demand for school inputs across locations, and providing a foundation for adjusting the levels of state and federal aid to local jurisdictions.

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[3] *Explanatory measures* refers to measures (e.g., independent variables) that are used to explain the patterns of variations in some specific variable (for example, wage rates).

[4] See Chambers (1977a), the **Technical Report,** which is a companion to this report for a more complete discussion of the use of the Herfindahl index.

[5] *Hedonic wage model* refers to a model of wage determination based on the characteristics of workers and the work place.

Methodology

The GCEI uses a *hedonic wage model* to examine the overall patterns of variation in the salaries and wages of certificated and noncertificated personnel. This model provides a comprehensive framework for understanding the various factors that underlie variations in the patterns of employee compensation. These factors include both *discretionary (demand) factors* that are within the control of local school decisionmakers (for example, district preferences for the personal qualifications of its employees), and *cost (supply) factors* that are outside local control (for example, cost of living, labor supply). In short, the hedonic wage model is well suited as a tool to isolate the impact of regional amenities and costs of living on the salaries of school personnel, while controlling for various personal and job characteristics. College quality is used in the analysis of certified salaries as an additional control variable, but inclusion of this measure of personnel quality had no significant impact on the estimated cost index values.

The GCEI analyses presented in this report draw upon several major data sources:

- Analyses of certificated school personnel uses data from the *Schools and Staffing Survey (SASS)* administered by NCES in 1987-88, 1990-91 and 1993-94.

- Analyses of noncertificated school personnel uses data from the *Current Population Surveys (CPS)* administered by the Bureau of Labor Statistics.

- Analyses of cost factors (for example, characteristics of the labor market and the communities within which public school districts are located) uses data from the *U.S. Geological Survey*, the *National Weather Service*, the *Uniform Crime Reports of the FBI*; and the *City and County Databook*.

- The price indices for the nonpersonnel inputs are derived from components of the *consumer price index (CPI)* and the *producer price index*.

Using the hedonic wage model, a comprehensive GCEI was constructed for each school district in the nation for each of three school years: 1987-88, 1990-91, and 1993-94. The GCEI is a composite index of all of the prices of the personnel and nonpersonnel school inputs purchased by school districts. It is a weighted average of these school inputs, where the weights are the average district budget shares for each school input—that is, the average proportion of total current expenditures allocated to the corresponding input (certificated personnel, noncertificated personnel, nonpersonnel). The index is benchmarked at 100 within each year for the school district serving the average student in the United States. That is, the geographic cost index for each district reflects the cost of providing comparable school inputs relative to the district serving the average student.

Geographic Variations in Costs and Real Educational Spending Across the United States

Perhaps the most prominent finding of the analyses of the patterns of variations in the GCEI is the dramatic differences across states in the access to educational resources and services and

the relationship between *actual* and *real* (or *cost-adjusted*) spending. Specific findings related to equity include the following:

- *Variations in costs.* Using 100 as an average, the 1993-94 GCEI ranges from a low of about 65 to a high of approximately 171 with a coefficient of variation of 10.7. That is, the highest cost district in the United States spends more than 2.6 (=171÷65) times as much as the lowest cost district to recruit and employ similar school personnel and nonpersonnel inputs. Despite this range, however, about two-thirds of the students in the United States are served in school districts facing cost differences within plus or minus 10.7 percent of the average.

- *Stability of the GCEI over time.* Although the factors affecting supply of, and demand for, school personnel change somewhat over time, there is a high correlation between the geographic cost indices for different years. GCEIs are estimated for three school years in this report: 1987-88, 1990-91, and 1993-94 (corresponding to the years of the *SASS* samples). The correlation between each pair of GCEIs across the 3-year intervals are about 0.98. The correlation between the GCEIs across the full 6-year span exceeds 0.96. This suggests that the patterns of geographic variations in costs do not change substantially over time and that the GCEI estimated for any given year provides a reasonable estimate of the GCEI for adjacent years. Put another way, the GCEI does not necessarily need to be updated every year.

- *Correlations among input price indices.* In addition to the high correlations over time, high correlations exist among the various school inputs at any given point in time. Correlations between the teacher and school administrator indices exceed 0.99, while the correlations between the price indices for certificated versus noncertificated personnel range from 0.80 to 0.89. This suggests that the same factors that affect variations in the prices of certificated personnel also affect the prices for noncertificated personnel in similar magnitudes.

- *Variations in actual expenditures.* State-by-state average educational expenditures per pupil vary by about 3 to 1. That is, the highest spending states spend, on average, about three times what the lowest spending states spend. Even comparing the states at the 90th versus the 10th percentile rankings reveals actual expenditure differences of 1.7 or 1.8 to 1 depending on the school year. The coefficient of variation (= the standard deviation expressed as a percent of the mean) ranges from 24.5-25.8 percent for the three sample years.

- *Variations in real expenditures.* Adjusting expenditures for differences in costs narrows this distribution somewhat. *Real* expenditures per pupil vary across states by as much as 2.4 - 2.6 to 1. The coefficient of variation of real expenditures per pupil ranges from 17.8 percent to 19.5 percent in the three sample years. Both the decrease in the ratios of the highest to lowest spending states and the decrease in the coefficient of variation in moving from actual to real spending reduce the appearance of inequality in the levels of resources devoted to educational services across states.

Implications for Future Research

The geographic cost-of-education index provides a tool for educational researchers to use in future analyses of the variations in educational expenditures and resource allocation. It may be used to deflate expenditure information at the local level for more comprehensive analyses of the patterns of difference in the level of real resources available across local school districts. It may be used by individual states as a starting point for analyses of their own patterns of variation in costs and for considering methods for adjusting state grants-in-aid to local districts for such variations in costs. Researchers may also use the index as a tool to understand the impact of variations in resource costs on the patterns of demand for different school resources.

Future research efforts should refine the databases upon which these analyses are based, as well as the methodology and the empirical application of the GCEI to improve the measures that have been developed in this report. Improving data in the following areas merits further investigation:

- *Fringe benefits.* The analysis of certificated and noncertificated personnel focuses entirely upon salaries and wages. The impact of adding benefits to this analysis is unknown at this point. Unfortunately, accurate and consistent benefit data are difficult to gather and incorporate into cost analyses. NCES needs to address this issue through improved data gathering within the *Schools and Staffing Survey (SASS)* or its other fiscal data collection efforts.

- *Noncertificated school personnel*. The analysis of data on noncertificated school personnel relies upon rather limited data from the *Current Population Surveys* (CPS). The CPS does not include a sample of school personnel sufficiently large to support the kind of analyses conducted in this study, and identifies only the metropolitan area in which the individual resides or is employed, rather than the specific county. Once again, *SASS* may offer potential for collecting data on samples of certain categories of noncertificated school personnel that may improve the quality of information on patterns of wage variations across geographic jurisdictions.

- *Other categories of nonpersonnel costs.* Analyses of nonpersonnel costs currently rely on creative solutions that use extant data sources or *ad hoc* decisions and assumptions about how costs vary across geographic locations. Measurement might well be improved by incorporating specific relevant questions within existing data collection activities already in place at NCES. Further research might also clarify the effects of several other geographic dimensions on the costs of nonpersonnel services (for example, proximity to points of production and service, climatic conditions, cost of energy).

- *Home-to-school transportation costs.* Transportation expenditures account for about 5 percent of the total current expenditures for educational services in the United States and range from about 1 to 9 percent across the country. These costs vary for a variety of reasons both within and beyond the control of local school decisionmakers. Understanding how these discretionary and nondiscretionary factors impact

transportation costs across districts would shed light on the patterns of geographic variations.

The Next Frontier: Pupil Needs and Scale as *Cost Factors*

While substantial progress has been made in the development of cost adjustments in education, much work clearly remains. Better data are required to analyze the costs of noncertificated school personnel. Extensions of existing data collection activities could improve the analysis of certain nonpersonnel items. Case studies could inform these efforts as well. Further work, perhaps involving engineering experts, could improve upon the analysis of energy costs and consumption patterns. And finally, more sophisticated econometric techniques could be applied to the analysis of home-to-school transportation costs to sort out the *cost* from the *discretionary factors*.

However, cost analysts face an even bigger challenge. The next frontier in the arena of education cost analysis involves improving our understanding of the cost effects of *educational needs of different student populations* and in the *scale of school and district operations*. While a true cost-of-education index requires a better assessment of the quality of educational services, it is even more true when assessing the impact of variations in pupil needs and scale of operations. Both of these dimensions require potentially significant differences in the way educational services are delivered. In the case of student needs, services to students with disabilities versus students without disabilities may involve substantial differences in the combinations and configurations of school inputs. Similarly, services delivered in very small schools or districts in remote locations will be organized in very different ways from their suburban or large district counterparts.

Continued work on educational costs is essential as NCES begins to explore the issues of productivity in education and recognizes the need to measure educational resource levels more accurately. Understanding productivity requires comprehension of the decisions that underlie the patterns of resource allocation in local school systems, and understanding these patterns requires a thorough understanding of the patterns of variation in the factors that affect the costs of educational services.

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Acknowledgments

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The author would like to acknowledge the valuable contribution of Jean Wolman. Ms. Wolman provided assistance in reorganizing my original manuscript into the three companion reports on the development and measurement of geographic and inflationary cost-of-education indices. This report is one of the three. Her careful review, detailed editing, and in some cases rewriting of these reports has helped to translate this document into a more readable and acceptable form.

A very special thank you is owed to Ann Win. Ann served as the programmer on this task as well as an earlier related task under this project for NCES. Ann has been responsible for organizing the complex and large datasets used for this analysis and for carrying out the many statistical analyses required to complete this report. Without her assistance and her ability to wade through complex instructions, dataset documentation, and data items, this project could not have been completed. I also appreciate her patience with me in the numerous trials that led up to the final analyses.

I would also like to express my gratitude to Don McLaughlin for his valuable comments on earlier drafts of this manuscript and for his guidance on specific statistical problems that arose in the conduct of this project. The current draft has benefitted greatly from his careful review.

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Chapter I

INTRODUCTION

Background and Motivation for Developing a Geographic Cost-of-Education Index

The desire to understand the patterns of variation in educational services across geographic regions of the United States has increased the need for meaningful and reliable measures of the patterns of educational cost differences. Government agencies, researchers, and the popular press produce and publish data on the patterns of expenditures across geographic jurisdictions (e.g., regions, states, and school districts). Often, however, their perspectives on the measurement of these different patterns of expenditures are overly simplistic.

Actual patterns of educational expenditure are a result of two components: (a) variations in the levels of educational services reflected in the quantity and quality of the resources used to produce those services (for example, teachers, aides, administrators, and computers), and (b) variations in the prices paid for each unit of a given resource. To account for these variations, it is necessary to adjust the *actual* values of expenditures that are commonly reported by public school systems in order to determine the *real* differences in educational services and resources across geographic jurisdictions. This adjustment is accomplished with a price index that reflects only that portion of the variation in the prices of educational resources due to factors beyond the control of local school decisionmakers (for example, inflation or geographic differences in the cost-of-living, geographical amenities like climate or crime rates, or competitiveness of the local labor market for school personnel).

A cost-of-education index across geographic locations *(subsequently referred to as GCEI)* would be useful for comparing expenditures or salary levels across states or local jurisdictions. The *GCEI* is an index that reflects overall variations in the salaries of comparable teachers, school administrators, and noncertificated school personnel, and the prices paid for similar nonpersonnel inputs (for example, supplies, books, and computers) *across geographic locations*. It measures how much more or less it costs to provide the same quantities and qualities of school inputs in different locations. By adjusting actual expenditure levels for variations in the prices paid for comparable resources across geographic locations, one can compare real differences in the level of educational services across states or local school districts.

A geographic cost-of-education index would be useful in providing important information to policymakers and educators who are increasingly interested in measuring the variations in the level of investment in education across states. A geographic cost-of-education index, specifically, would help to answer the following question:

How much more or less does it cost to recruit and employ teachers, administrators, and other school personnel, and to pay for nonpersonnel school costs in different geographic locations at a point in time?

In order to examine the relationship between level of educational services/resources (or inputs) and educational outcomes (or outputs), one might want direct measures of the quantities and qualities of different services/resources in order to examine the input-output relationships—that is, the impact on output levels associated with changes in the levels of inputs—are crucial to understanding productivity. Another approach that provides an overall measure of the changes in the level of resources would involve the use of a price deflator or geographic cost-of-education index for school resources.[6] A price deflator would reflect geographic differences in the prices of *comparable* school inputs which, when applied to *actual* expenditures, would provide an estimate of the *real* expenditure or the *real* (the cost-adjusted level of expenditures on school inputs) invested in educational services.[7]

Previous Literature on Geographic Costs

Several previous studies have focused on the development of geographic cost-of-education indices, and researchers have applied various approaches to derive geographic cost indices. The earlier studies (e.g., Brazer, 1974; Barro, 1974) tended to focus on analyses of teachers' salaries only. Some used the district as the unit of observation (e.g., Brazer, 1974; Grubb and Hyman, 1975) and attempted to explain variations in average salaries or salary levels at points on the salary scale as the dependent variable. In other cases, the individual teacher is used as the unit of observation for the analysis of salaries, while district level data are used to simulate cost differences (e.g., Chambers, 1978c, 1980b; Augenblick and Adams, 1979; Chambers and Parrish, 1984; Wendling, 1979). Virtually all previous studies with the exception of Chambers (1995) focus on a single state.

The most comprehensive approach to the development of geographic cost adjustments in education are reflected in the early studies of Chambers and Parrish (1982 and 1984) and the more recent study by Duncombe, Ruggiero, and Yinger (1996). These studies include geographic price adjustments for school inputs as part of a larger effort to capture all of the factors affecting educational cost differences, including pupil needs and scale of operations. The Chambers and Parrish (1982 and 1984) effort uses the Resource Cost Model (RCM) approach to address pupil needs and scale of operations. The RCM is a bottom-up approach to education cost analysis and relies heavily on the specifications developed by programmatic experts of the resource requirements necessary to meet the needs of special student populations and the needs of schools and districts of different sizes. Programmatic experts are asked to describe in great detail the specific service delivery systems (for example, the staffing configurations and nonpersonnel resources which make up classrooms, pull-out programs, pupil support services such as counseling, and administrative offices) to meet the needs of particular types of students across districts of varying sizes. The RCM is very much an input-oriented approach and can be tedious, though valuable, decision making exercise.

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[6] *Price deflator* refers to an index used to adjust actual input prices for differences associated with factors that are outside the control of local decisionmakers.

[7] The term *actual* refers to the values of expenditures reported by school districts or state agencies. The term *real* (or *cost-adjusted*) refers to measures that have been adjusted by dividing the actual values by a cost index—in this case, the geographic cost-of-education index—so that comparisons may be made between figures from different time points.

Most recently, Duncombe, Ruggiero, and Yinger (1996) have proposed an outcomes-based approach, which results in a more comprehensive cost-of-education index. They propose the use of econometric techniques to estimate an educational cost function that controls for educational outcomes while accounting for variations in the school input prices and the composition of student enrollments. Their educational cost index would presumably account for differential effects of prices and student needs. Conceptually, this outcome perspective would be the preferred approach to estimating and measuring patterns of cost variations. First, it encompasses both input price differences as well as student needs. Second, it has the potential of taking into account patterns of input substitution that occur in response to differences in relative prices and differences in the technology requirements associated with pupil needs. Third, and perhaps most important, it focuses attention on a critical bottom line—the outcomes of the process—which is, after all, what the educational enterprise is all about.

Although the Duncombe *et al* (1996) study is conceptually on the right track, the empirical problems faced in pursuing this methodology are enormous. First, one needs adequate and comprehensive measures of the outcomes of schools. To their credit, Duncombe *et al* (1996) do go a little beyond achievement test scores by including the percent of students who drop out and the percent receiving regents' diplomas in their analysis of New York state. Nevertheless, the variables still represent a relatively limited view of what schools are supposed to produce. The model does not reflect the multiple areas of student learning (mathematics, language arts, science, and social science) or other noncognitive outcomes that might be reflected in student behavior, attitudes toward learning, or program participation.

Second, Duncombe *et al* (1996) need to develop a formal, mathematical model of the ways in which school inputs are translated into school outputs. The log-linear model Duncombe *et al* (1996) choose is relatively restrictive in the way it reflects the technology of educational production.[8] Given the state of the art for understanding input-output relationships in schools, the requirement to develop such a formal model represents an enormously challenging undertaking (see Hanushek, 1996).

Third, Duncombe *et al* (1996) need to use measures of the number of pupils with special needs (for example, the percentages of students in special education programs, who are limited-English proficient, or who are enrolled in Title I) which are outside the control of local decision makers.[9] The Duncombe *et al* (1996) study treats these programmatic enrollments as if they are outside local control when, in fact, program regulations and the factors that affect program eligibility places these enrollment numbers within the control of school decisionmakers.[10]

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[8] The potential problems with this restrictive model are reflected to some degree by the sensitivity of the statistical estimates Duncombe *et al* (1996) obtained to changes in the specification of the model (for example, the inclusion of outputs and the inclusion of measures of pupil-needs).

[9] This is a topic currently being addressed in a project being conducted by Jay Chambers as part of the agenda of the Center for Special Education Finance located at the American Institutes for Research.

[10] While school decision makers are certainly not free to choose to serve children with disabilities, they can affect which and how many children are classified as disabled. For a discussion of the issues surrounding variations in the process of identification of children, see Ysseldyke and Algozzine (1982).

Finally, Duncombe *et al* (1996) need to acquire adequate measures of school input prices adjusted for "personnel qualifications." Again to their credit, Duncombe *et al* (1996) explicitly recognize the interdependence between spending decisions and teachers' salaries and use an analytical method to focus on the factors affecting teachers' salaries that are outside the control of local school decision makers. Duncombe *et al* (1996) use the district as the unit of analysis, which limits the ability to control for differences in teacher characteristics and working conditions in the district. Moreover, Duncombe *et al* (1996) use a relatively limited set of measures (for example, 1990 county population, median income, and district enrollment) which affect the supply and hence cost of teachers in local districts.

Purpose of This Report

With these issues in mind, the purpose of this report is to develop a comprehensive geographic cost index for school inputs (i.e., services and resources). The analyses presented focus on the prices of the inputs purchased by schools. It is important to note, however, that the analysis in no way attempts to measure the impact on educational costs of differences in special student needs (e.g., needs of students with disabilities, limited-English proficiency). Nonetheless, the indices presented in this report could well be used with RCM-based or outcome-based approaches (like Duncombe *et al* (1996)) to adjust for differences in input prices.

The approach offered in this report is unique. It builds on previous work by Chambers (1995b) in which the National Center for Education Statistics's (NCES) *Schools and Staffing Survey (SASS)* for 1990-91 is used to develop a teacher cost index. The report goes beyond this 1995 study to make several significant contributions:[11]

- ***Improvements in explanatory measures.*** The analysis improves upon the previous work by incorporating additional measures of teacher quality (e.g., more precise measures of teacher experience and quality of the undergraduate college attended), exploring alternative ways of measuring teacher experience, including more accurate data on local crime rates, controlling for the effects of collective bargaining, and using a more sophisticated measure of labor market competitiveness (that is, the Herfindahl index).[12]

- ***Extension to additional school inputs.*** The report takes a significant step toward developing a comprehensive nationwide geographic cost index by developing separate school input price indices for school administrators, selected categories of noncertificated school personnel, and specific categories of nonpersonnel inputs. Data derived from the public school administrator questionnaires of the NCES *Schools and Staffing Survey (SASS)* are used to estimate hedonic salary equations in much the same way as was done for teachers' salaries earlier (Chambers, 1995). The hedonic wage methodology was also applied to selected samples of individuals who hold jobs similar to those of noncertificated school personnel throughout the United States (derived from the *Current Population Surveys).*

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[11] Another contribution of this research is that the methodology can be used to measure inflation in the prices of school inputs. For a further discussion of this application of the hedonic wage model, the reader is referred to Chambers (1997-II).

[12] See Chambers (1977a), the **Technical Report,** which is a companion to this report for a more complete discussion of the use of the Herfindahl index.

- ***Application to expenditure data.*** The *GCEI* is applied to state level expenditure data to illustrate how such indices might be used to adjust actual expenditure data reported by NCES. Analysis of the patterns of actual and real (cost adjusted) school spending across geographic regions of the United States are presented using the GCEI developed for the three sample years included in the SASS data.

The geographic index developed in this report focuses directly on school inputs with an effort to adjust for the qualitative differences in those inputs employed across geographic locations. The *GCEI* controls for variations in a fairly wide range of personal and job characteristics which affect the supply of, and demand for, school personnel. It reflects differences across geographic locations in factors which underlie cost-of-living differences and differences in the characteristics of regions that affect the desirability of these locations as places to live and work. In addition, the methodology used in this analysis reduces the influence of forces within the control of school decisionmakers by including in the estimates of the *GCEI* only those factors that are beyond local control. Finally, the geographic cost adjustments developed in this report contribute to the policy debate surrounding school finance in three ways.

- The *GCEI* improves the way in which the NCES can report fiscal information across geographic locations within the United States. Expenditure and salary data can be expressed in terms that reflect real service levels rather than simply reporting actual dollars;

- The *GCEI* can be used to further understand the factors that affect changes in the patterns of demand for school inputs across geographic locations. Economists and other analysts may use the component price indices as explanatory variables in such analyses, as suggested above for the Duncombe *et al* (1996) study; and

- The *GCEI* may form the foundation for adjusting the levels of state and federal aid to local jurisdictions. The *GCEI* estimated for individual school districts may eventually be used to adjust the distributions of state aid to local school districts in order to provide similar levels of purchasing power to districts located in different geographic locations within states. Similarly, the federal government could also consider ways of using the *GCEI* to adjust the distribution of educational program dollars to states or local districts to reflect differences in the purchasing power of the educational dollar.

Organization of Report

The remainder of this report is organized into three chapters. Chapter II briefly describes the underlying variables and methodology used to develop the geographic cost-of-education index. Chapter III applies the index to examine the distribution and patterns of variations in the costs of education across geographic locations, as well as the implications for the variations in educational spending at the state level. Chapter IV concludes the report with a summary of the accomplishments of the analysis and a view toward future research on cost adjustments in education.

Companion Reports

This report on the geographic cost-of-education index is one of three companion reports. Another, *Measuring Inflation in Public School Costs*, is similar in format to this report, but focuses on the development of an *inflationary* cost-of-education index. The inflationary cost index measures the changes in the prices of comparable school inputs over time.

The third report, *The Measurement of School Input Price Differences: A Technical Report on Geographic and Inflationary Differences in the Prices of Public School Inputs*, is a technical report that (a) describes the methodological and empirical framework for the analyses used to produce both the geographic and inflationary cost-of-education indices, (b) discusses the methods used for estimating costs for certificated school personnel, noncertificated school personnel, and nonpersonnel school inputs, (c) presents the empirical results of the analyses, including patterns of variation in the overall cost-of-education across geographic locations and over time, and (d) includes technical appendices.

Chapter II

METHODOLOGY

This section provides a methodological and empirical context for the analyses presented in this report. First, it defines the three major categories of school inputs that are included in the analysis of expenditures used to create the cost-of-education index. Second, it briefly describes the conceptual and empirical frameworks and data sources used to develop the geographic cost-of-education index (GCEI). Finally, the chapter discusses the development of the index.

Major Categories of School Inputs

As mentioned earlier, this report goes beyond previous efforts (Chambers, 1995b) to develop a geographic cost-of-education index by developing separate school price indices for three categories of school inputs. These three categories of inputs are described briefly below:[13]

- ***Certified school personnel inputs:*** teachers, instructional support and related service personnel, school-level administrators, and district-level administrative and support personnel. Certificated personnel account for the largest portion of educational expenditures. Teachers alone account for approximately 50 percent of school district budgets, while instructional support personnel and administrators add another 10 to 12 percent.

- ***Noncertified school personnel inputs*:** instructional aides (paraprofessionals), clerical and office staff, custodial and maintenance staff, transportation personnel, food service personnel, and administrative and technical personnel. Noncertificated personnel account for approximately 18 to 20 percent of school district budgets.

- ***Nonpersonnel school inputs:*** purchased services (for example, professional services from specialists, therapists, or technical personnel not employed by the school district), books (texts and other), supplies and materials, furnishings and equipment, travel, utilities, and facilities. Nonpersonnel inputs account for approximately 15 to 20 percent of the average school district budget. The present analysis includes cost estimates of contractual personnel and some limited geographic variations in energy prices.

Although each of these input categories requires a slightly different conceptual or empirical foundation for the analysis presented in this report, they follow the basic approach described below.

[13] The index previously developed by Chambers (1995b) included only an analysis of teachers' salaries.

Conceptual Framework - Hedonic Wage Model

Analyses of personnel uses the *hedonic wage model* to examine the overall patterns of variation in the salaries and wages of certificated and noncertificated personnel. This model provides a comprehensive framework for understanding the various factors that underlie variations in the patterns of employee compensation. It is well suited as a tool to isolate the impact of regional amenities and costs of living on the salaries of school personnel, while controlling for various personal and job characteristics.[14]

The explanatory factors included in the hedonic wage analysis represent *discretionary factors* and *cost factors*. The *discretionary factors* are those that are within the control of local school decisionmakers (for example, district preferences for the personal qualifications of its employees), while the *cost factors* are those that are outside local control (for example, cost of living, labor supply).[15] The *discretionary factors* included such factors as race-ethnicity, marital status by gender, highest degree attainment, college quality, previous experience and longevity, breaks in service, measures of teacher effort (extra hours), and extent of collective bargaining. The *cost factors* include percent of minority students, district size, distance of the district office from the central city, climate, crime rates, competition in the market for school personnel, and other demographic and urban characteristics (e.g., population density and population of the county, rates of growth in population, and housing costs). The personnel cost indices involve running simulations of the salaries and wages paid to comparable personnel across local school districts. More concretely, these simulations involve examination of the *variations in wages or salaries associated only with the variations in the cost factors, while controlling for (holding constant) the influence of the discretionary factors.*[16] The personnel cost indices reflect *how much more or less it costs in different geographic locations for recruiting and employing comparable school personnel*.

Data Sources

The primary data source for the analysis of certificated school personnel (that is, teachers and school administrators) is the *Schools and Staffing Survey (SASS)* administered in 1987-88, 1990-91 and 1993-94 by NCES.[17] The primary data source for the analysis of noncertificated school

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[14] For a more detailed discussion of the theoretical and empirical application of the hedonic wage method to the analysis of salaries of school personnel, see Chambers (1981b). For a comprehensive review of the literature and empirical issues in utilization of the hedonic wage model see Chambers (1981a).

[15] In the traditional economics literature, these *discretionary* and *cost factors* have been referred to as the *demand* and *supply factors* that affect teachers salaries. The terms *discretionary* and *cost factors* have been adopted here to convey the critical distinction between the *demand* and *supply factors*—that is, the extent of control by local school district decision makers. Local decision makers have control, at least in the long run, over the *demand factors* which includes the characteristics and qualifications of personnel, while they have no control over the factors which affect the willingness of school personnel to *supply* their services to local school districts. By virtue of their effect on the *supply* of school personnel, these factors affect the *cost* of comparable personnel in different locations— hence the name *cost factors*.

[16] See Chambers (1997-III) for a comprehensive description of the empirical methods used to derive the geographic cost-of-education index.

[17] The statistical analysis underlying the certificated school personnel indices focuses on the salaries of teachers and school administrators. Unfortunately, there are no data on instructional support and related service personnel or on district-level administrators that would support similar analyses. The teacher cost index is used as an estimate of the costs of instructional support and related service personnel, and the school administrator cost index is used as an

personnel (e.g., teacher aides, custodial personnel, secretaries/clerical personnel, and accounting or technical service personnel) is the *Current Population Surveys (CPS)* administered by the Bureau of Labor Statistics. *CPS* samples were obtained to correspond to the same years as the *SASS* data for certificated school personnel. The *SASS* and the *CPS* data provide information on the salaries and wages, terms of employment, personal qualifications and background characteristics, and the specific characteristics of jobs and job assignments for these noncertificated school personnel. The *SASS* sample is limited to the two specific categories of public school district employees. However, the *CPS* sample includes individuals who held occupations similar to those typically found in public school districts, but who were employed by virtually all public or private sector employers. Extending the sample to other nonpublic school employers not only increases the sample size, but also recognizes that these categories of noncertificated occupations are quite similar to those employed in other sectors of the economy.

The data on *cost factors* include a variety of characteristics of the labor market and the communities within which public school districts are located. Data items and sources include district size and race-ethnic composition of students from NCES sources; distance from the district office to the nearest central city derived from data taken from the *U.S. Geological Survey*; climatic conditions from the *National Weather Service*; violent crime rates for cities derived from the *Uniform Crime Reports of the FBI*; a measure of competition in the market for school personnel based on the concentration of county enrollments (using the Herfindahl index); and demographic and urban factors derived from the *City and County Databook* (for example, population, population density, and population growth of the region—county or metropolitan area in which the district is located—and the median value or cost of housing in the county). These data were merged with the detailed personnel data derived from the *SASS* and *CPS* sources.

The price indices for the nonpersonnel items are derived from components of the *consumer price index* and the *producer price index*. The costs of certain contracted services purchased by school districts are estimated from the personnel cost indices for certificated and noncertificated school personnel.

Impact of College Quality

The analysis of teacher and other personnel costs constantly cries out for improved measures of quality. Such measures of personnel quality are important for the purpose of sorting out the differences in salaries that are associated with differences in quality of personnel versus differences in the *cost factors*. For a subset of the *SASS* sample years, data on the quality of the students attending the undergraduate colleges attended by teachers and school administrators are available. The names of the undergraduate colleges attended by individual teachers and school administrators are recorded in the *SASS* questionnaires and these names were matched to data on the average *Scholastic Aptitude Tests (SAT)* scores for entering freshman for 1972,

estimate of the district-level administrative personnel.

1977, and 1982.[18] Average SAT scores were included as one measure of the quality of teachers and school administrators in the salary analysis conducted for this study.

Unfortunately, these data on personnel quality were not available for all sample years. Specifically, these data were not available for 1990-91 for teachers and for 1990-91 and 1987-88 for school administrators.[19] One question that arises is whether inclusion of this measure of personnel quality in the analysis has any impact on the estimated cost indexes. In the years for which these data were available, indexes were calculated based on two statistical analyses: one controlling for college quality and one excluding college quality from the analysis. These analyses suggest that controlling for college quality showed little measurable impact on the calculation of the teacher or school administrator cost indexes. In fact, the correlations between those teacher and school administrator cost indexes with and without controls for college quality exceeded 0.99. Nevertheless, statistical analyses were conducted to adjust the indexes in those years in which college quality data were not reported to account for any impact that the inclusion of college quality data might have had.[20]

Development of the Geographic Cost-of-Education Index (GCEI)

The GCEI is a composite index of all of the prices of the personnel and nonpersonnel school inputs purchased by school districts. Specifically, it is a weighted average of these personnel and nonpersonnel school inputs, where the weights are the average district budget shares for each school input—that is, the average proportion of total current expenditures allocated to the corresponding input (certificated personnel, noncertificated personnel, nonpersonnel).[21] This is commonly referred to as a *fixed-market-basket* index, and is similar to the procedure used in the development of the overall *consumer price index* (CPI).[22]

The companion technical report (Chambers, 1997-III) provides a comprehensive description of the development of the geographic cost-of-education index (GCEI), as well as overall results of analyses of salaries paid to certificated and noncertificated school personnel. The next chapter of this report describes the results in terms of geographic variations in costs and real educational spending across the nation.

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[18] These data are from the *Higher education Research Institute at the Graduate School of Education*, Electronic database on SAT scores for entering Freshman, 1972, 1977, 1982 in approximately 2,300 colleges in the United States.

[19] The reason for this was that the *SASS* teacher and principal surveys did not request the undergraduate college attended for those years (1990-91 for teachers and 1987-88 and 1990-91 for principals).

[20] See appendix C of the technical report on the development of geographic and inflationary cost-of-education indexes by Chambers (1997-III).

[21] Data on budget shares used to calculate the GCEI are derived from a combination of state databases created for Ohio and California. Ohio data were used because Ohio's educational expenditures are at about the average for the United States, and because they provided relatively good detail on budget shares for nonpersonnel inputs. The California data were used to break down the relatively aggregated categories for school personnel in the Ohio data. California also includes a relatively diverse set of school districts in terms of size and urbanization, which is similar to those throughout the remainder of the country.

[22] The CPI is a composite of the various component price indices for consumer goods and services published by the Bureau of Labor Statistics.

Chapter III

GEOGRAPHIC VARIATIONS IN COSTS AND REAL EDUCATIONAL SPENDING ACROSS THE UNITED STATES

This chapter addresses the question:

> *How much more or less does it cost to provide the same levels of educational resources across different geographic locations across the United States?*

Using the conceptual and empirical foundation described in chapter II, the analysis of certificated and noncertificated salaries and the variations in the prices of certain nonpersonnel school inputs were combined to produce a comprehensive cost-of-education index across geographic locations in the United States. (This index is subsequently referred to as the *GCEI*.) The *GCEI* was constructed for each school district in the nation for each of three school years: 1987-88, 1990-91, and 1993-94. These years were selected primarily because of the availability of the detailed *SASS* data which include large representative samples of teachers and school administrators. The index is benchmarked at 100 within each year for the school district serving the average student in the United States.[23] That is, the geographic cost index for each district reflects the cost of providing comparable school inputs relative to the district serving the average student. Although indices were actually calculated for each school district in the United States, much of the analysis of expenditures presented in this chapter is summarized at the state level.[24]

Only those variations in the personnel salaries across geographic locations within a given year that are due solely to variations in the values of the *cost factors* are included in the overall geographic cost-of-education index. It is not surprising that the overall patterns of variation in educational costs are dominated by personnel, and more specifically by certificated personnel, since certificated personnel account, on average, for over 63 percent of total school district expenditures. Noncertificated school personnel account for another 17 percent of the budget.

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[23] That is, the weighted mean value of the geographic cost-of-education index *(GCEI)* is 100 where the weight is the total enrollment of the school district.

[24] These indices are available from the *Data Resource and Development Division of the National Center for Education Statistics* upon request.

Geographic Cost Differences

Table III-1 presents the patterns of variations in the *GCEI* for all three sample years, along with the variations in the component indices. All indices have a weighted mean value of 100.0 where total district enrollment is used as the weight. In other words, the district serving the average student in the United States corresponds to the mean cost for each school input category.

It is not surprising to find that the magnitudes and regional patterns of geographic cost differences are quite similar over time and among the various inputs. In 1993-94, the G*CEI* ranged from a low of 65.3 to a high of 170.7 with a coefficient of variation of 10.7. The ratio of the maximum to the minimum *GCEI* is 2.6 to 1, which indicates that educational costs in the highest cost districts in the United States are approximately 160 percent higher than they are in the lowest cost district. The magnitudes of these differences are pretty much the same for each of the individual categories of school personnel inputs. Moreover, for the most part, these magnitudes hold pretty constant over the three sample years for which data are available.

At the mean index value of 100, the standard error of the G*CEI* is less than 1 percent.[25] The standard errors for the components indices for *certificated school personnel* (i.e., teachers and school administrators) at the mean index value are also less than 1 percent. In fact, with the exception of Alaska, the standard errors of the mean values of the *GCEI* by state are less than 1 percent. While Alaska exhibits a standard error exceeding 2 percent, the standard errors for the remainder of the states vary from 0.3 to 0.7 percent.[26]

[25] The standard errors of the various component indices are based on the standard errors of the regression parameters used in the analyses. Calculation of these standard errors assumes that the values of the *cost factors* are fixed for each district in the sample. Of course, standard errors calculated in this fashion do not account for errors in measurement of the *cost factors* or errors that may occur in the specification of the functional form of the salary equation. For more details on the regression analyses used, see the technical report (Chambers, 1997-III).

[26] The standard errors of these indices appear in appendix E of the technical report (Chambers, 1997-III).

Table III-1— Geographic cost indices for each input category across the United States for each of the sample years 1993-94, 1990-91, 1987-88[a]

(1)	Descriptive Statistics for the Geographic Cost-of-Education Index by Sample Year: *Mean* (2)	*Coefficient of variation* (3)	*Minimum* (4)	*Maximum* (5)	Ratio of Max. to Min. (6)
1993-94 (Number of districts=14,633 , Total enrollment=43,199,754					
Geographic Cost-of-Education Index *(GCEI)*	100.0	10.7	65.3	170.7	2.61
Certificated personnel					
Teachers	100.0	13.4	55.3	187.8	3.40
School administrators	100.0	12.5	51.5	235.1	4.56
Noncertificated school personnel					
Management, Accounting, Technical services	100.0	10.9	70.8	124.8	1.76
Bldg, grounds maint., trades, crafts, security, & transp.	100.0	8.4	67.3	160.3	2.38
Paraprofessionals, teaching aides, food services	100.0	6.8	74.2	129.1	1.74
Secretaries, clerical, and health services	100.0	10.5	65.8	126.7	1.92
Non-personnel inputs combined	100.0	4.8	86.2	126.2	1.46
1990-91 (Number of districts=15,013 , Total enrollment=40,971,849					
Geographic Cost-of-Education Index *(GCEI)*	100.0	11.1	60.6	165.0	2.72
Certificated personnel					
Teachers	100.0	13.5	49.1	185.5	3.78
School administrators	100.0	13.2	42.8	175.0	4.09
Noncertificated school personnel					
Management, Accounting, Technical services	100.0	11.1	69.7	123.4	1.77
Bldg, grounds maint., trades, crafts, security, & transp.	100.0	9.8	67.9	159.5	2.35
Paraprofessionals, teaching aides, food services	100.0	9.7	69.4	131.7	1.90
Secretaries, clerical, and health services	100.0	11.6	63.2	135.0	2.14
Non-personnel inputs combined	100.0	4.8	85.2	124.7	1.46

Table III-1— Geographic cost indices for each input category across the United States for each of the sample years 1993-94, 1990-91, 1987-88[a] —continued

(1)	Descriptive Statistics for the Geographic Cost-of-Education Index by Sample Year				Ratio of Max. to Min.
	Mean (2)	*Coefficient of variation* (3)	*Minimum* (4)	*Maximum* (5)	(6)
1987-88 (Number of districts=15,305 , Total enrollment=39,753,459					
Geographic Cost-of-Education Index *(GCEI)*	100.0	9.9	66.6	181.3	2.72
Certificated personnel					
Teachers	100.0	12.0	57.1	206.8	3.62
School administrators	100.0	12.3	55.2	186.9	3.39
Noncertificated school personnel					
Management, Accounting, Technical services	100.0	10.2	69.9	142.1	2.03
Bldg, grounds maint., trades, crafts, security, & transp.	100.0	9.2	71.6	192.7	2.69
Paraprofessionals, teaching aides, food services	100.0	7.8	74.3	151.4	2.04
Secretaries, clerical, and health services	100.0	10.6	65.0	140.0	2.15
Non-personnel inputs combined	100.0	4.2	87.4	133.3	1.52

[a] The mean reflects the index value of the district serving the average student in the United States. The *coefficient of variation* is the percentage that the standard deviation is of the mean (i.e., = 100 x standard deviation ÷ mean). The *minimum* and *maximum* are self explanatory, while the ratio in column (6) is simply the *maximum* divided by the *minimum*.

Source: The geographic cost-of-education indexes are based on statistical analyses of the patterns of differences in the wages and prices of school inputs. Data sources include the following: (a) Bureau of the Census: *Current Population Surveys, 1987- 1994;* 1990 Census of Governments, *Survey of Local Government Finances; County level census files*; (b) Bureau of Labor Statistics: *Producer Price Indices*-1985 - 1994 data; *Consumer Price Indices.* 1985 - 1994 data; (c) California Department of Education and Ohio Department of Education, databases on expenditures by object codes; (d) Geographic Names Information Systems (GNIS) CD-ROM (Latitudes and longitudes for most U.S. cities, towns and geographic locations; (e) *Higher education Research Institute at the Graduate School of Education*, Electronic database on SAT scores for entering Freshman, 1972, 1977, 1982 in approximately 2,300 colleges in the United States; (f) National Climatic Data Center and the National Center for Atmospheric Research, *The World Wealth Disc: Climate Data for the Planet Earth. CD-ROM*; (g) U.S. Department of Education, National Center for Education Statistics, *Common Core of Data; Schools and Staffing Survey;* 1990 Census School District Special Tabulation (summary file set I); (h) U.S. Federal Bureau of Investigation. (1995). The Uniform Crime Report (UCR), Return A, for the U.S. Washington, D.C.: U.S. Department of Justice. Cost indexes for certified personnel are estimated at the school district level. The statistical estimates underlying the cost indexes for non-certified school personnel are based on data for individuals identified by metropolitan area, though estimates of the index values are calculated estimated for counties and other smaller regions within metropolitan and non-metropolitan areas. See Chambers (1997) for details of the estimation techniques.

The overall patterns of variation are reflected in the standard deviations which, because the distribution is centered on 100.0, also reflect the value of the coefficient of variation. Variations in the certificated cost indices range from about 12 to 13.5 percent depending on the sample year.

The range of variation for the *noncertificated occupations* is smaller, ranging from a low of 6.8 percent to a high of 11.6 percent depending on the occupational category and the sample year. However, it should be noted that one of the reasons for the smaller variation is that the data on which the estimates for noncertificated occupations are based are aggregated to a higher level. While the certificated cost analysis is carried out at the district level, the noncertificated cost analysis is carried out at the level of the metropolitan or nonmetropolitan areas within states, and the indices are based, to the extent possible, on county or regional values of the *cost factors* included in the analysis. One might expect to find somewhat larger variations if the observations in the dataset used for noncertificated pay rates could be identified by county or by school district.

Variations in the *nonpersonnel school inputs* predominantly reflect variations in the costs of (a) contracted services for which certain categories of noncertificated occupations are used as a proxy and (b) the limited data available on geographic differences in energy prices (for natural gas, electricity, and gasoline for vehicle operation). The remaining categories of nonpersonnel school inputs (accounting for about 10 percent of total school district budgets) are assumed to exhibit no variations in costs across geographic locations. It is likely that certain items may well be purchased on national markets and exhibit relatively little variation in the price paid by local school districts.[27] The coefficient of variation for nonpersonnel school inputs suggests about a 4 percent variation in these costs in each of the sample years.

Although the factors affecting supply of, and demand for, school personnel, change somewhat over time, there is a very high correlation between the geographic cost indices for different years. The implication is that geographic cost variations appear to be relatively stable over time. The correlation for the *GCEI* between the 1987-88 and 1990-91 and between 1990-91 and 1993-94 is about 0.98. Even across the full 6-year span (between the *GCEI* for 1987-88 and 1993-94), the correlation exceeds 0.96. Similar correlations occur among the individual component indices: the correlations across the 6-year time span are somewhat lower than the correlations across the 3-year time spans.[28]

These high correlations over time are consistent with previous studies of geographic cost differences over time by Chambers (1981a). Two new aspects of this analysis are that these geographic cost indices are nationwide rather than for any single state, and they span a longer period of time than previous studies. Across all of the inputs, the high correlations suggest a

[27] This is not to say that there are not other factors that should ultimately be taken into account in the analysis of nonpersonnel costs. The last chapter of this report discusses issues related to freight costs (the costs of transporting supplies and materials to the districts and schools), the costs of energy services, and the costs of home-to-school transportation services that need to be addressed in further analyses of educational costs.

[28] See appendix D, table D-1, in the technical report (Chambers, 1997-III) for details on the correlations of the overall and component geographic cost indices over time. All of these correlations are in the range of .95 to .99.

relatively stable pattern of cost variation over a much longer period of time. The earlier work by Chambers compares results in two consecutive years in Missouri (1975-76 and 1976-77) and two years with one year in between (1977-78 and 1979-80) in California. The current work compares these geographic cost differences spanning a 6-year interval from 1987-88 to 1993-94. This stability is not particularly surprising since the locational or geographic factors that affect regional variations in costs are not likely to change dramatically within short time intervals.

In addition to high correlations over time, there are also high correlations among the various school input cost indices at any given point in time.[29] For example, the teacher and school administrator cost indices exhibit a correlation exceeding 0.99 in each sample year. The correlations between the certificated and noncertificated input cost indices fall in the range of 0.80 - 0.89 across all sample years. The correlations between the personnel and nonpersonnel indices are also all above 0.90, but this is not a surprising result since some of the components of the nonpersonnel categories are based on personnel indices.

Table III-2 provides information on the patterns of cost differentials with respect to three specific characteristics of the districts: district size as measured by enrollment, the size of the metropolitan area or county (for districts in non-metropolitan areas) in which the district is located, and the distance from the closest central city. This last characteristic provides some information on districts located in, or immediately adjacent to, central cities (less than 10 miles from the closest central city), those which are more than likely suburban districts (10 to 50 miles), districts located on the fringes of metropolitan areas (50 to 100 miles), and districts located in increasingly remote, rural areas of the United States. All of the districts located greater than 400 miles from the nearest central city are in Alaska.

In general, all of these indices suggest the same pattern exhibited in previous studies (for example, see Chambers, 1981a) of geographic differences in educational costs. Larger districts, districts in more populous urban areas, and districts closest to the central cities tend to exhibit the highest costs. These patterns are consistent with the higher costs of living, higher crime rates, more competitive labor markets for school personnel, and greater levels of congestion associated with urban life. At the same time, the more remote rural areas of the United States pay higher salaries, all else equal, to compensate for the isolated life style, the limited access to some of the amenities of urban life (for example, access to shopping and medical facilities as well as alternative employment opportunities) and the higher costs of living in these regions. In addition, these remote regions also exhibit a harsher climate, which is also associated with additional employee compensation, all else equal.

[29] Details on the correlations among the component indices within each year are presented in appendix D, table D-1.

Table III-2— Patterns of variations in geographic cost indices in the United States by district size, the size of metropolitan area, and distance from the central city for 1987-88,1990-91, and 1993-94.

	Mean value of the GCEI for:		
	1987-88	1990-91	1993-94
By district size (enrollment):			
Under 1,000	89.9	88.7	89.8
1,001 to 5,000	96.6	96.7	97.6
5,001 to 10,000	100.3	100.6	100.9
10,001 to 25,000	102.5	102.1	102.2
25,001 to 100,000	102.5	101.8	101.0
Greater than 100,000	109.1	109.5	105.9
By population of the metropolitan area or county for non-metropolitan areas:			
Under 10,000	85.6	83.4	83.3
10,001 to 50,000	88.3	87.1	87.2
50,001 to 100,000	92.5	91.5	91.6
100,001 to 500,000	95.8	95.4	95.4
500,001 to 1,000,000	98.4	98.0	97.9
1,000,001 to 5,000,000	103.6	103.7	103.6
Greater than 5,000,000	113.7	115.1	114.3
By distance from the closest central city:			
Less than 10 miles	104.3	105.4	106.6
10 to 50 miles	100.3	100.8	100.6
50 to 100 miles	92.6	91.8	91.7
100 to 200 miles	92.1	90.6	90.4
200 to 400 miles	93.1	90.4	89.9
Greater than 400 miles	142.6	128.5	126.7

Source: The geographic cost-of-education indexes are based on statistical analyses of the patterns of differences in the wages and prices of school inputs. Data sources include the following: (a) Bureau of the Census: *Current Population Surveys, 1987- 1994;* 1990 Census of Governments, *Survey of Local Government Finances; County level census files*; (b) Bureau of Labor Statistics: *Producer Price Indices*-1985 - 1994 data; *Consumer Price Indices.* 1985 - 1994 data; (c) California Department of Education and Ohio Department of Education, databases on expenditures by object codes; (d) Geographic Names Information Systems (GNIS) CD-ROM (Latitudes and longitudes for most U.S. cities, towns and geographic locations; (e) *Higher education Research Institute at the Graduate School of Education*, Electronic database on SAT scores for entering Freshman, 1972, 1977, 1982 in approximately 2,300 colleges in the United States; (f) National Climatic Data Center and the National Center for Atmospheric Research, *The World Wealth Disc: Climate Data for the Planet Earth. CD-ROM*; (g) U.S. Department of Education, National Center for Education Statistics, *Common Core of Data; Schools and Staffing Survey;* 1990 Census School District Special Tabulation (summary file set I); (h) U.S. Federal Bureau of Investigation. (1995). The Uniform Crime Report (UCR), Return A, for the U.S. Washington, D.C.: U.S. Department of Justice. Cost indexes for certified personnel are estimated at the school district level. The statistical estimates underlying the cost indexes for non-certified school personnel are based on data for individuals identified by metropolitan area, though estimates of the index values are calculated estimated for counties and other smaller regions within metropolitan and non-metropolitan areas. See Chambers (1997) for details of the estimation techniques.

Table III-3 presents the overall geographic cost indices by state for each of the three sample years. Focusing attention on the most recent year, the five states exhibiting the highest costs of education are Alaska (126.7), Massachusetts (117.2), New Jersey (115.2), Connecticut (115.1), and New York 112.2). A 95 percent confidence interval for the *GCEI* for Alaska does not overlap with any of the other top five states. Moreover, the *GCEI* for Massachusetts is statistically significantly higher than the *GCEI* for New Jersey and Connecticut, and finally, New York's GCEI is statistically significantly lower than Connecticut.

The five states exhibiting the lowest costs of education are North Dakota (85.3), South Dakota (85.4), Mississippi (87.2), Arkansas (87.1), and Iowa (88.2). Based on the estimated standard errors of the *GCEI*, 95 percent confidence intervals for North Dakota and South Dakota do not over lap with those of the other three lowest four states. The differences between Mississippi, Arkansas, and Iowa are not statistically significant.

Another dimension worth examining is the variation in costs within the state. For this purpose, the District of Columbia and the State of Hawaii are excluded since each includes only one district. States exhibiting the smallest coefficient of variation include Nevada (2.0 percent), West Virginia (2.5 percent), Wyoming (2.7 percent), South Dakota (3.5 percent), and Mississippi (3.6 percent). These states tend to be among the smallest states in terms of total enrollment and total number of school districts. States exhibiting the largest coefficient of variation for cost differences include Missouri (10.2 percent), Minnesota (9.7 percent), Illinois (9.5 percent), Alaska (7.09 percent), and New York (7.9 percent). With the exception of Alaska, these states tend to be among the larger states in terms of total enrollment and total number of districts. Alaska reports only 56 county-wide school districts in 1993-94. Minnesota and Missouri report 400 and 534 school districts, while New York and Illinois report 714 and 922 school districts, respectively. Greater populations and larger numbers of districts suggest greater potential for diversity of circumstances and, hence, costs across local school districts. The diversity of Alaska in terms of terrain, climate, and degree of remoteness speaks for itself.

As one can see, the South as a region tends to exhibit the lowest costs of education, while the Northeast and far western states of Washington and California exhibit the highest costs. The smaller and less urbanized Midwestern states tend to fall in the middle to low ranges of cost, while in general the more urbanized states exhibit higher costs of education.

Table III-3— Geographic cost-of-education index by state for 1987-88, 1990-91, and 1993-94

State	1993-94 No. Of Districts	1993-94 Enrollment	Descriptive Statistics for the Geographic Cost-of Education Index by Sample Year: Sample Year 1987-88 Mean	Coeff of Var.	Min.	Max.	Ratio: Max to Min.	Sample Year 1990-91 Mean	Coeff of Var.	Min.	Max.	Ratio: Max to Min.	Sample Year 1993-94 Mean	Coeff of Var.	Min.	Max.	Ratio: Max to Min.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
U.S.	14,633	43,199,754	100.0	9.9%	66.6	181.3	2.72	100.0	11.1%	60.6	165.0	2.72	100.0	10.7%	65.3	170.7	2.61
Alabama	127	730,004	92.2	4.1%	82.5	98.3	1.19	90.1	4.1%	77.4	95.9	1.24	89.3	4.2%	80.1	95.9	1.20
Alaska	56	125,513	142.6	8.2%	107.9	181.3	1.68	128.5	6.3%	97.5	165.0	1.69	126.7	7.0%	100.6	170.7	1.70
Arizona	217	708,705	101.0	4.0%	71.7	108.8	1.52	99.9	5.0%	67.6	105.2	1.56	99.2	5.0%	71.7	104.0	1.45
Arkansas	315	444,271	88.9	5.0%	75.2	97.4	1.29	86.9	5.3%	71.7	95.0	1.32	87.1	5.0%	74.5	95.1	1.28
California	1,057	5,266,546	113.0	6.0%	77.7	122.2	1.57	114.9	6.3%	76.9	128.2	1.67	111.6	6.1%	77.6	124.3	1.60
Colorado	176	624,421	98.9	4.9%	78.9	108.4	1.37	97.9	5.0%	76.2	107.9	1.42	98.6	5.6%	78.6	109.8	1.40
Connecticut	166	479,522	108.5	4.4%	90.1	116.1	1.29	112.9	4.5%	92.4	120.8	1.31	115.1	4.4%	97.5	122.2	1.25
Delaware	19	105,547	100.8	3.7%	92.0	104.3	1.13	101.1	4.1%	82.9	104.8	1.26	102.3	3.6%	93.8	105.9	1.13
District of Columbia	1	80,678	106.9	0.0%	106.9	106.9	1.00	105.8	0.0%	105.8	105.8	1.00	107.4	0.0%	107.4	107.4	1.00
Florida	67	2,039,884	97.1	3.7%	82.9	103.8	1.25	98.5	5.1%	83.1	108.1	1.30	95.7	4.8%	79.8	111.1	1.39
Georgia	181	1,235,304	95.6	7.7%	77.6	107.3	1.38	94.6	7.5%	75.3	104.7	1.39	93.1	8.1%	73.3	104.4	1.42
Hawaii	1	180,529	98.6	0.0%	98.6	98.6	1.00	100.0	0.0%	100.0	100.0	1.00	99.7	0.0%	99.7	99.7	1.00
Idaho	113	236,774	92.4	3.5%	76.3	97.3	1.28	91.7	3.5%	72.5	97.8	1.35	92.0	3.6%	75.9	96.5	1.27
Illinois	922	1,875,956	102.3	9.6%	74.7	114.9	1.54	101.4	9.8%	70.6	114.5	1.62	103.2	9.5%	74.3	116.6	1.57
Indiana	292	962,026	93.1	6.2%	81.7	103.3	1.26	92.1	6.0%	80.1	100.8	1.26	93.5	6.2%	81.2	103.0	1.27
Iowa	396	497,192	88.1	5.5%	74.1	96.8	1.31	87.3	5.7%	70.5	95.5	1.35	88.2	5.7%	70.9	96.2	1.36
Kansas	304	457,744	90.1	7.2%	74.2	100.0	1.35	89.3	7.6%	71.2	99.7	1.40	89.4	7.4%	73.1	99.3	1.36
Kentucky	176	641,375	89.4	5.4%	77.5	96.7	1.25	88.4	5.5%	77.1	96.3	1.25	89.4	5.1%	77.7	97.8	1.26
Louisiana	66	798,312	93.2	4.3%	83.4	99.2	1.19	91.0	4.8%	82.6	98.2	1.19	89.4	4.6%	80.7	96.6	1.20
Maine	226	211,399	97.8	3.5%	79.4	103.6	1.30	98.1	5.0%	71.7	106.4	1.48	98.1	5.9%	74.3	107.7	1.45

Table III-3— Geographic cost-of-education index by state for 1987-88, 1990-91, and 1993-94—continued

State	1993-94 No. Of Districts	1993-94 Enrollment	Sample Year 1987-88 Mean	Sample Year 1987-88 Coeff of Var.	Sample Year 1987-88 Min.	Sample Year 1987-88 Max.	Sample Year 1987-88 Ratio: Max to Min.	Sample Year 1990-91 Mean	Sample Year 1990-91 Coeff of Var.	Sample Year 1990-91 Min.	Sample Year 1990-91 Max.	Sample Year 1990-91 Ratio: Max to Min.	Sample Year 1993-94 Mean	Sample Year 1993-94 Coeff of Var.	Sample Year 1993-94 Min.	Sample Year 1993-94 Max.	Sample Year 1993-94 Ratio: Max to Min.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
			Descriptive Statistics for the Geographic Cost-of Education Index by Sample Year														
Maryland	24	772,638	102.5	4.3%	89.4	108.7	1.22	102.9	3.9%	90.5	109.2	1.21	102.1	3.5%	90.1	105.8	1.18
Massachusetts	317	852,707	109.6	4.4%	79.2	116.3	1.47	113.1	4.4%	76.4	120.7	1.58	117.2	4.6%	91.5	124.9	1.37
Michigan	556	1,598,444	99.8	5.9%	71.7	112.0	1.56	98.1	6.0%	64.8	110.1	1.70	101.6	6.8%	68.6	115.0	1.68
Minnesota	400	807,275	97.5	8.3%	75.5	109.4	1.45	97.0	8.8%	68.5	108.8	1.59	98.1	9.7%	75.5	111.4	1.47
Mississippi	149	501,652	90.1	3.5%	83.0	96.4	1.16	88.0	3.6%	81.8	93.4	1.14	87.2	3.6%	80.7	92.5	1.15
Missouri	534	852,324	93.7	8.8%	69.6	106.9	1.54	92.7	9.3%	65.7	107.2	1.63	94.9	10.2%	69.1	111.7	1.62
Montana	486	162,814	91.7	4.6%	72.3	98.7	1.36	89.7	5.6%	65.1	97.8	1.50	90.9	4.7%	69.6	98.8	1.42
Nebraska	676	283,988	89.3	8.0%	66.6	98.8	1.48	88.0	8.6%	60.6	96.4	1.59	88.6	8.0%	65.3	97.1	1.49
Nevada	17	235,800	98.8	2.4%	89.0	107.9	1.21	100.3	1.7%	87.6	106.4	1.21	95.3	2.0%	84.3	100.0	1.19
New Hampshire	164	185,360	100.9	4.6%	81.8	107.9	1.32	104.9	6.4%	79.9	113.1	1.42	104.8	5.8%	81.3	112.1	1.38
New Jersey	583	1,144,496	110.2	4.8%	83.8	118.5	1.41	111.9	5.2%	87.4	122.3	1.40	115.2	5.6%	92.0	126.1	1.37
New Mexico	88	322,172	96.2	3.8%	81.1	102.5	1.26	94.9	5.6%	75.4	100.9	1.34	92.9	4.1%	77.4	96.8	1.25
New York	714	2,705,833	110.5	8.6%	81.2	120.2	1.48	113.2	9.4%	77.9	124.0	1.59	112.2	7.9%	81.1	126.5	1.56
North Carolina	121	1,131,662	93.8	4.4%	83.5	100.6	1.21	92.0	4.3%	82.6	98.6	1.19	91.7	4.0%	81.8	97.4	1.19
North Dakota	251	119,127	89.1	5.5%	71.7	95.4	1.33	86.7	7.0%	65.1	94.3	1.45	85.3	5.6%	67.7	90.8	1.34
Ohio	611	1,813,999	97.4	6.0%	77.0	107.4	1.39	96.3	5.8%	69.8	105.3	1.51	98.8	6.0%	79.1	108.8	1.38
Oklahoma	554	604,076	91.3	6.7%	72.9	99.3	1.36	88.2	7.2%	66.8	96.0	1.44	90.2	6.3%	71.2	97.5	1.37
Oregon	271	515,971	97.0	4.3%	73.7	102.6	1.39	97.7	4.5%	69.1	103.9	1.50	96.6	4.5%	74.7	102.0	1.37
Pennsylvania	500	1,720,681	99.1	6.4%	82.5	112.2	1.36	99.4	7.1%	81.4	114.8	1.41	102.5	6.8%	84.1	119.3	1.42
Rhode Island	36	144,918	104.5	2.8%	93.8	109.5	1.17	107.7	2.6%	94.9	111.4	1.17	110.3	3.2%	97.7	114.5	1.17
South Carolina	95	636,456	93.4	3.5%	85.8	98.8	1.15	91.8	3.3%	83.6	96.3	1.15	90.5	3.5%	82.2	96.8	1.18
South Dakota	73	135,984	87.1	5.7%	70.7	93.5	1.32	85.7	6.8%	66.8	93.0	1.39	85.4	6.2%	68.4	92.5	1.35
Tennessee	138	857,014	92.6	5.4%	80.5	100.3	1.24	91.1	5.4%	78.5	100.0	1.27	91.3	4.8%	78.8	98.4	1.25
Texas	1,046	3,601,660	97.5	7.0%	72.8	106.9	1.47	94.9	7.1%	61.3	103.7	1.69	94.3	6.9%	66.0	103.2	1.56
Utah	40	469,811	96.3	3.4%	81.9	100.9	1.23	96.0	2.7%	82.1	99.6	1.21	95.5	3.6%	81.4	100.5	1.23

Table III-3— Geographic cost-of-education index by state for 1987-88, 1990-91, and 1993-94— continued

	Descriptive Statistics for the Geographic Cost-of Education Index by Sample Year																
	1993-94		Sample Year 1987-88					Sample Year 1990-91					Sample Year 1993-94				
State	No. Of Districts	Enrollment	Mean	Coeff of Var.	Min.	Max.	Ratio: Max to Min.	Mean	Coeff of Var.	Min.	Max.	Ratio: Max to Min.	Mean	Coeff of Var.	Min.	Max.	Ratio: Max to Min.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Vermont	251	101,377	95.2	4.1%	81.3	102.4	1.26	96.8	5.4%	71.4	106.2	1.49	98.9	4.9%	74.7	107.0	1.43
Virginia	133	1,045,471	97.9	7.7%	81.8	111.5	1.36	100.9	8.1%	83.6	119.4	1.43	96.9	7.0%	80.9	113.1	1.40
Washington	296	915,952	102.1	7.0%	75.0	112.7	1.50	102.8	7.6%	71.8	114.0	1.59	103.8	6.8%	76.7	114.2	1.49
West Virginia	55	313,750	88.1	2.7%	81.7	92.4	1.13	87.5	3.0%	80.4	94.0	1.17	89.6	2.5%	82.7	95.0	1.15
Wisconsin	427	843,741	96.1	6.1%	81.5	105.7	1.30	95.1	6.0%	79.5	105.1	1.32	95.6	6.0%	80.3	105.7	1.32
Wyoming	49	100,899	94.6	3.3%	84.8	100.5	1.19	93.7	3.5%	82.1	99.7	1.21	91.6	2.7%	81.8	95.2	1.16

Source: The geographic cost-of-education indexes are based on statistical analyses of the patterns of differences in the wages and prices of school inputs. Data sources include the following: (a) Bureau of the Census: *Current Population Surveys, 1987- 1994;* 1990 Census of Governments, *Survey of Local Government Finances; County level census files*; (b) Bureau of Labor Statistics: *Producer Price Indices*-1985 - 1994 data; *Consumer Price Indices.* 1985 - 1994 data; (c) California Department of Education and Ohio Department of Education, databases on expenditures by object codes; (d) Geographic Names Information Systems (GNIS) CD-ROM (Latitudes and longitudes for most U.S. cities, towns and geographic locations; (e) *Higher education Research Institute at the Graduate School of Education*, Electronic database on SAT scores for entering Freshman, 1972, 1977, 1982 in approximately 2,300 colleges in the United States; (f) National Climatic Data Center and the National Center for Atmospheric Research, *The World Wealth Disc: Climate Data for the Planet Earth. CD-ROM*; (g) U.S. Department of Education, National Center for Education Statistics, *Common Core of Data; Schools and Staffing Survey;* 1990 Census School District Special Tabulation (summary file set I); (h) U.S. Federal Bureau of Investigation. (1995). The Uniform Crime Report (UCR), Return A, for the U.S. Washington, D.C.: U.S. Department of Justice. Cost indexes for certified personnel are estimated at the school district level. The statistical estimates underlying the cost indexes for non-certified school personnel are based on data for individuals identified by metropolitan area, though estimates of the index values are calculated estimated for counties and other smaller regions within metropolitan and non-metropolitan areas. See Chambers 1997 for details of the estimation techniques.

Differences in *Real* Expenditures across Geographic Locations

Table III-4 presents patterns of variation in the actual versus cost-adjusted educational expenditures per pupil across the 50 states and the District of Columbia (DC) for each of the three sample years. The first section of the table presents the descriptive statistics and the ratios that reflect the dispersion of *actual* per pupil expenditures across the 50 states and DC. The mean reflects the actual dollar value of educational services provided by the state serving the average child in the United States within each sample year.

The second section of table III-4 presents cost-adjusted expenditure data across the states. These data adjust the actual expenditure data by state for the average cost of providing comparable educational resources and services to the children in the state. The mean value of the *GCEI* used for each state appears in table III-3. Since the mean value of the *GCEI* is set at 100 for each year, the mean value of actual and cost-adjusted expenditures are virtually identical except for differences caused by rounding.

Table III-4— Measuring differences in educational investment across states: actual versus cost-adjusted expenditures

Statistic	*School Year* 1987-88	1990-91	1993-94
Using Actual Expenditures			
Mean	$3,927	$4,902	$5,325
Minimum	$2,302	$2,767	$3,206
Maximum	$7,079	$8,166	$9,075
Ratios of:			
Maximum to minimum	3.08	2.95	2.83
90th to 10th percentile	1.79	1.78	1.69
75th to 25th percentile	1.35	1.35	1.31
Coefficient of variation <a>	25.8%	25.2%	24.5%
Using Cost-Adjusted Expenditures			
Mean	$3,926	$4,901	$5,325
Minimum	$2,390	$2,883	$3,358
Maximum	$5,609	$7,590	$8,234
Ratios of:			
Maximum to minimum	2.35	2.63	2.45
90th to 10th percentile	1.63	1.57	1.50
75th to 25th percentile	1.32	1.25	1.25
Coefficient of variation <a>	19.5%	19.2%	17.8%

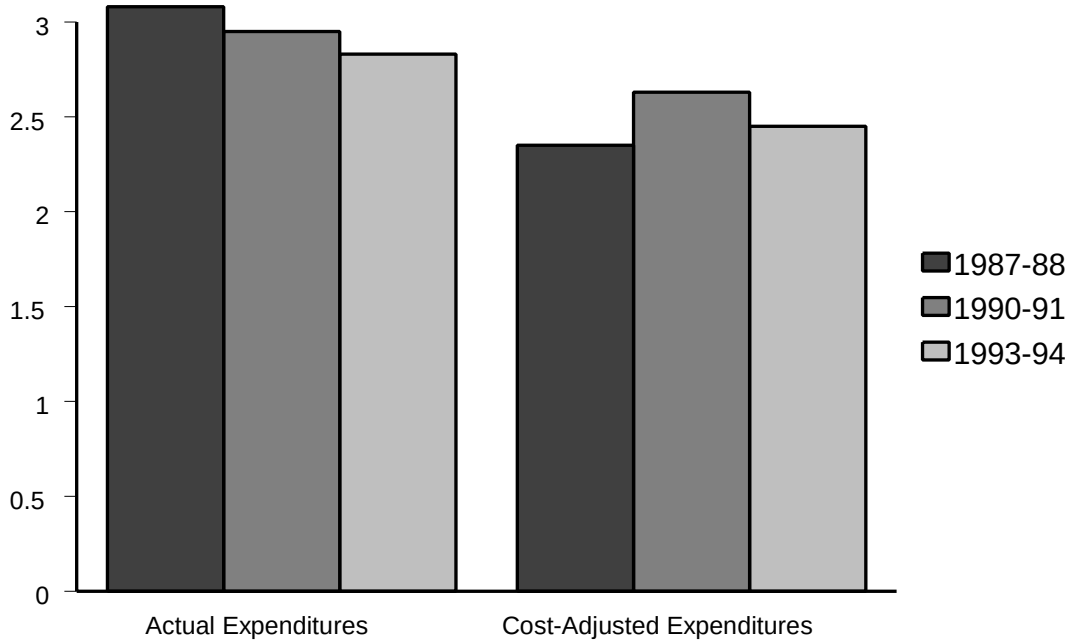
<a> The coefficient of variation is defined as the standard deviation expressed as a percentage of the mean value.

Formally, this may be expressed as follows:

Coeff of Var = 100 x Stdev/Mean.

Source: The geographic cost-of-education indexes are based on statistical analyses of the patterns of differences in the wages and prices of school inputs. Data sources include the following: (a) Bureau of the Census: *Current Population Surveys, 1987- 1994;* 1990 Census of Governments, *Survey of Local Government Finances; County level census files*; (b) Bureau of Labor Statistics: *Producer Price Indices*-1985 - 1994 data; *Consumer Price Indices.* 1985 - 1994 data; (c) California Department of Education and Ohio Department of Education, databases on expenditures by object codes; (d) Geographic Names Information Systems (GNIS) CD-ROM (Latitudes and longitudes for most U.S. cities, towns and geographic locations; (e) *Higher education Research Institute at the Graduate School of Education*, Electronic database on SAT scores for entering Freshman, 1972, 1977, 1982 in approximately 2,300 colleges in the United States; (f) National Climatic Data Center and the National Center for Atmospheric Research, *The World Wealth Disc: Climate Data for the Planet Earth. CD-ROM*; (g) U.S. Department of Education, National Center for Education Statistics, *Common Core of Data; Schools and Staffing Survey;* 1990 Census School District Special Tabulation (summary file set I); (h) U.S. Federal Bureau of Investigation. (1995). The Uniform Crime Report (UCR), Return A, for the U.S. Washington, D.C.: U.S. Department of Justice. Cost indexes for certified personnel are estimated at the school district level. The statistical estimates underlying the cost indexes for non-certified school personnel are based on data for individuals identified by metropolitan area, though estimates of the index values are calculated estimated for counties and other smaller regions within metropolitan and non-metropolitan areas. See Chambers 1997 for details of the estimation techniques.

Figure III-1— Ratio of maximum to minimum expenditures for actual versus cost-adjusted expenditures



Source: See table III-4.

Based on the results in tables III-3 and III-4, high spending states appear to be high cost states. That is, some of the difference between states with regard to actual educational expenditures can be accounted for by differences in the costs of educational services. By adjusting actual educational expenditures per pupil for differences in costs, one can measure *real* differences in the investment in educational services across the states. If the *GCEI* is an accurate representation of differences in school input price, then adjusting actual educational expenditures for cost differences allows one to compare levels of educational spending across states. Cost-adjusted figures reflect real differences in the quantities and characteristics of school inputs across the states.[30]

While the means are virtually identical across the years (because the cost index is centered on the mean value of the distribution), the range of variation in cost-adjusted or *real* educational expenditures per pupil is narrowed relative to the range of variation in *actual* expenditures per

[30] The GCEI presented in this report does not reflect educational cost differences associated with production technology involved in the provision of energy and home-to-school transportation services. Specifically, the production of energy services such as heating and cooling of classrooms will be affected by climatic conditions. Moreover, the provision and cost of home-to-school transportation services will be affected by population density and dispersion as well as climactic conditions which affect gas mileage and repair requirements. The analysis in the present report ignores technological factors of production to focus attention on price differences of inputs.

pupil.[31] The ratio of the highest spending state to the lowest spending state in 1987-88 is 2.35 in *real* terms compared to 3.08 in *actual* terms. The ratio of the state at the 90th to the state at the 10th percentile is 1.63 in *real* terms compared to 1.79 in *actual* terms. The difference becomes significantly smaller when comparing states at the 75th to the 25th percentiles, which exhibit a ratio of 1.32 in *real* terms and 1.35 in *actual* terms.

Changes in the patterns of expenditures across states. Table III-5 provides the state-by-state data that underlie the distributional information presented in table III-4. Data on *actual* and *real* total current expenditures per pupil are presented by state for each sample year. The index of *actual* and *real (or cost-adjusted*) expenditures per pupil reflects the relative level of *actual* and *real* spending across all states. The national average spending level is benchmarked at 100. An index of 125 indicates that a state spends 25 percent higher than the average, while an index value of 75 indicates that a state spends 25 percent less than the average.

The table also presents state rankings on *actual* and *cost-adjusted* expenditures per pupil for each of the three years. The highest spending state is ranked number 1, and the lowest spending state is ranked 51. The states are listed in alphabetical order. The five lowest ranking states (those ranked 47 to 51) are shaded, while the five highest spending states (those ranked 1 to 5) have borders around the rankings.

Table III-5 reveals some interesting patterns of variation in the levels of resources devoted to K-12 educational services across states. These are most clearly exhibited by focusing attention on the indices of *actual* and *cost-adjusted* expenditures across states. Unlike the cost indices presented in table III-3, these indices reflect differences in the levels of resources allocated to educational services across states.

Figure III-2 also presents the state-by-state data that compares *actual* versus *cost-adjusted* expenditures per pupil. The states are listed in ascending order according to *actual* expenditure per pupil (the open bar). The black bar on the chart shows the *cost-adjusted* value of educational expenditure per pupil.

Highest versus lowest spending states. The data in table III-5 and figure III-2 indicate that in 1987-88, the highest spending state in the United States (Alaska) was spending more than 80 percent more than the state serving the average student, while the lowest spending state (Utah) was spending more than 40 percent less than the state serving the average student. Compared in another way, Alaska was spending more than three times what Utah was spending on educational services in
1987-88. By 1993-94, the ratio of the highest to lowest spending states had declined from 3.08 to 2.83, and while Utah was still at the bottom, Alaska had been replaced by New Jersey as the highest spending state.

[31] The term *real* is often used by economists to refer to dollar figures that are adjusted for cost differences and therefore reflect differences in the levels or quantities of the underlying resources or items being purchased. Suppose E = expenditures on some item, P = the price of the item, and Q = the quantity of the item. By definition, E=P×Q. If one thinks of E as educational expenditures, P as a price index of educational services, then E÷P=Q which is an estimate of the quantity of educational inputs. That is, E÷P is an estimate of the *real* quantity of educational inputs or services.

Figure III-2 - Actual and cost-adjusted expenditures per pupil across states

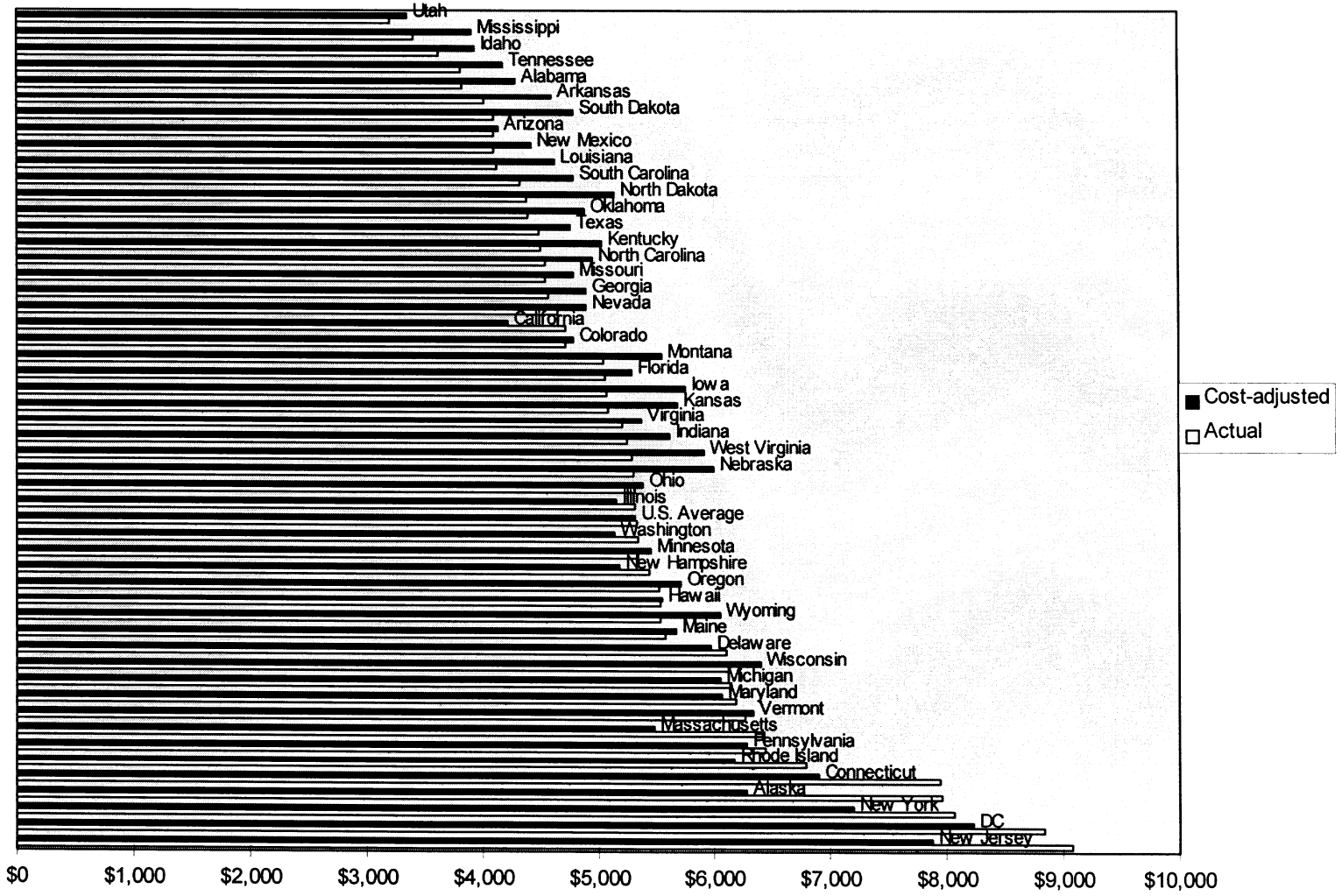


Table III-5— Actual and cost-adjusted total current expenditure per pupil and indices of actual and cost-adjusted expenditures by state for 1987-88, 1990-91, and 1993-94

State	Total current expenditures per pupil (Actual dollars)			Index of actual expenditures per pupil			Rankings of actual expenditures per pupil			Total current expenditures per pupil (Cost-adjusted by CEIL)			Index of cost adjusted expenditures per pupil			Rankings of real expenditures per pupil		
	1987-88	1990-91	1993-94	1987-88	1990-91	1993-94	1987-88	1990-91	1993-94	1987-88	1990-91	1993-94	1987-88	1990-91	1993-94	1987-88	1990-91	1993-94
U.S. Average	$3,927	$4,902	$5,325	100	100	100				$3,926	$4,901	$5,325	100	100	100			
Alabama	$2,569	$3,429	$3,826	65	70	72	48	48	47	$2,786	$3,806	$4,286	71	78	80	48	48	45
Alaska	$7,079	$7,502	$7,960	180	153	149	1	5	4	$4,964	$5,836	$6,283	126	119	118	7	7	8
Arizona	$3,498	$3,860	$4,104	89	79	77	32	41	44	$3,463	$3,865	$4,135	88	79	78	35	47	48
Arkansas	$2,771	$3,461	$4,013	71	71	75	46	47	46	$3,119	$3,982	$4,605	79	81	86	44	44	43
California	$3,877	$4,595	$4,718	99	94	89	21	28	32	$3,431	$4,000	$4,226	87	82	79	36	43	46
Colorado	$3,878	$4,603	$4,727	99	94	89	19	27	31	$3,921	$4,701	$4,796	100	96	90	25	30	37
Connecticut	$5,905	$7,547	$7,947	150	154	149	4	3	5	$5,441	$6,686	$6,903	139	136	130	3	3	4
Delaware	$4,606	$5,458	$6,101	117	111	115	10	11	13	$4,570	$5,401	$5,961	116	110	112	10	13	14
District of Columbia	$5,662	$8,029	$8,843	144	164	166	5	2	2	$5,296	$7,590	$8,234	135	155	155	4	1	1
Florida	$3,778	$4,859	$5,063	96	99	95	26	21	29	$3,892	$4,933	$5,290	99	101	99	26	24	27
Georgia	$3,195	$4,171	$4,569	81	85	86	38	36	34	$3,343	$4,411	$4,905	85	90	92	40	35	34
Hawaii	$3,661	$4,820	$5,532	93	98	104	29	22	16	$3,712	$4,817	$5,547	95	98	104	29	29	22
Idaho	$2,505	$3,206	$3,628	64	65	68	49	49	49	$2,713	$3,497	$3,943	69	71	74	49	49	49
Illinois	$3,822	$4,904	$5,323	97	100	100	25	20	21	$3,734	$4,835	$5,158	95	99	97	28	28	29
Indiana	$3,454	$4,588	$5,245	88	94	98	33	29	25	$3,710	$4,982	$5,611	94	102	105	30	22	20
Iowa	$3,867	$4,418	$5,070	98	90	95	24	32	28	$4,389	$5,062	$5,747	112	103	108	15	21	16
Kansas	$3,724	$4,434	$5,081	95	90	95	27	31	27	$4,133	$4,966	$5,681	105	101	107	20	23	18
Kentucky	$2,710	$3,897	$4,505	69	80	85	47	40	37	$3,033	$4,407	$5,039	77	90	95	47	36	32
Louisiana	$2,886	$3,853	$4,133	74	79	78	44	42	42	$3,098	$4,234	$4,625	79	86	87	45	41	42
Maine	$3,965	$4,978	$5,569	101	102	105	18	17	14	$4,054	$5,073	$5,675	103	104	107	22	20	19
Maryland	$4,575	$5,930	$6,191	117	121	116	12	9	10	$4,464	$5,765	$6,066	114	118	114	13	8	10
Massachusetts	$4,965	$5,881	$6,423	126	120	121	6	10	8	$4,532	$5,200	$5,478	115	106	103	11	18	23
Michigan	$4,350	$5,394	$6,138	111	110	115	13	12	11	$4,361	$5,500	$6,044	111	112	114	16	12	11
Minnesota	$4,132	$4,946	$5,342	105	101	100	16	19	19	$4,239	$5,101	$5,448	108	104	102	17	19	24
Mississippi	$2,416	$3,007	$3,410	62	61	64	50	50	50	$2,683	$3,418	$3,913	68	70	73	50	50	50
Missouri	$3,425	$4,271	$4,547	87	87	85	34	34	35	$3,657	$4,610	$4,789	93	94	90	32	31	39
Montana	$3,878	$4,706	$5,043	99	96	95	20	25	30	$4,230	$5,246	$5,550	108	107	104	18	16	21
Nebraska	$3,712	$4,735	$5,310	95	97	100	28	24	23	$4,157	$5,382	$5,997	106	110	113	19	14	13
Nevada	$3,298	$4,294	$4,661	84	88	88	36	33	33	$3,339	$4,281	$4,892	85	87	92	41	39	35
New Hampshire	$4,080	$5,152	$5,433	104	105	102	17	16	18	$4,045	$4,913	$5,184	103	100	97	23	27	28
New Jersey	$6,059	$8,166	$9,075	154	167	170	3	1	1	$5,499	$7,296	$7,876	140	149	148	2	2	2
New Mexico	$3,190	$3,757	$4,106	81	77	77	39	43	43	$3,317	$3,961	$4,420	84	81	83	42	45	44
New York	$6,196	$7,510	$8,069	158	153	152	2	4	3	$5,609	$6,637	$7,195	143	135	135	1	4	3
North Carolina	$3,153	$4,237	$4,540	80	86	85	40	35	36	$3,360	$4,604	$4,949	86	94	93	39	32	33
North Dakota	$3,239	$3,909	$4,385	82	80	82	37	39	40	$3,636	$4,509	$5,142	93	92	97	33	34	31
Ohio	$3,595	$4,747	$5,319	92	97	100	30	23	22	$3,690	$4,931	$5,382	94	101	101	31	25	25
Oklahoma	$2,897	$3,639	$4,403	74	74	83	43	45	39	$3,174	$4,128	$4,883	81	84	92	43	42	36
Oregon	$4,266	$5,195	$5,522	109	106	104	15	15	17	$4,400	$5,317	$5,715	112	108	107	14	15	17
Pennsylvania	$4,603	$6,048	$6,443	117	123	121	11	7	7	$4,644	$6,083	$6,285	118	124	118	9	6	7
Rhode Island	$4,924	$5,934	$6,797	125	121	128	8	8	6	$4,714	$5,510	$6,164	120	112	116	8	11	9
South Carolina	$3,143	$4,009	$4,335	80	82	81	41	38	41	$3,363	$4,369	$4,788	86	89	90	38	37	40
South Dakota	$3,071	$3,726	$4,095	78	76	77	42	44	45	$3,524	$4,349	$4,793	90	89	90	34	38	38
Tennessee	$2,855	$3,521	$3,813	73	72	72	45	46	48	$3,085	$3,865	$4,178	79	79	78	46	46	47
Texas	$3,334	$4,048	$4,488	85	83	84	35	37	38	$3,419	$4,267	$4,761	87	87	89	37	40	41
Utah	$2,302	$2,767	$3,206	59	56	60	51	51	51	$2,390	$2,883	$3,358	61	59	63	51	51	51
Vermont	$4,927	$6,255	$6,266	125	128	118	7	6	9	$5,174	$6,461	$6,335	132	132	119	5	5	6
Virginia	$3,873	$4,965	$5,205	99	101	98	23	18	26	$3,957	$4,921	$5,370	101	100	101	24	26	26
Washington	$3,875	$4,652	$5,342	99	95	100	22	26	20	$3,796	$4,524	$5,144	97	92	97	27	33	30
West Virginia	$3,579	$4,571	$5,292	91	93	99	31	30	24	$4,061	$5,221	$5,908	103	107	111	21	17	15
Wisconsin	$4,296	$5,382	$6,126	109	110	115	14	13	12	$4,471	$5,659	$6,405	114	115	120	12	10	5
Wyoming	$4,742	$5,310	$5,534	121	108	104	9	14	15	$5,016	$5,670	$6,042	128	116	113	6	9	12

Source for table III-5 and figure III-2: The geographic cost-of-education indexes are based on statistical analyses of the patterns of differences in the wages and prices of school inputs. Data sources include the following: (a) Bureau of the Census: *Current Population Surveys, 1987- 1994;* 1990 Census of Governments, *Survey of Local Government Finances; County level census files*; (b) Bureau of Labor Statistics: *Producer Price Indices*-1985 - 1994 data; *Consumer Price Indices.* 1985 - 1994 data; (c) California Department of Education and Ohio Department of Education, databases on expenditures by object codes; (d) Geographic Names Information Systems (GNIS) CD-ROM (Latitudes and longitudes for most U.S. cities, towns and geographic locations; (e) *Higher education Research Institute at the Graduate School of Education*, Electronic database on SAT scores for entering Freshman, 1972, 1977, 1982 in approximately 2,300 colleges in the United States; (f) National Climatic Data Center and the National Center for Atmospheric Research, *The World Wealth Disc: Climate Data for the Planet Earth. CD-ROM*; (g) U.S. Department of Education, National Center for Education Statistics, *Common Core of Data; Schools and Staffing Survey;* 1990 Census School District Special Tabulation (summary file set I); (h) U.S. Federal Bureau of Investigation. (1995). The Uniform Crime Report (UCR), Return A, for the U.S. Washington, D.C.: U.S. Department of Justice. Cost indexes for certified personnel are estimated at the school district level. The statistical estimates underlying the cost indexes for non-certified school personnel are based on data for individuals identified by metropolitan area, though estimates of the index values are calculated estimated for counties and other smaller regions within metropolitan and non-metropolitan areas. See Chambers (1997) for details of the estimation techniques.

Rounding out the top five states in 1987-88 are New York, New Jersey, Connecticut, and Washington, DC. By 1993-94, the order of the top five spending states had changed, but the list had not—states in the top five in 87-88 were still among the top five spenders in 93-94.

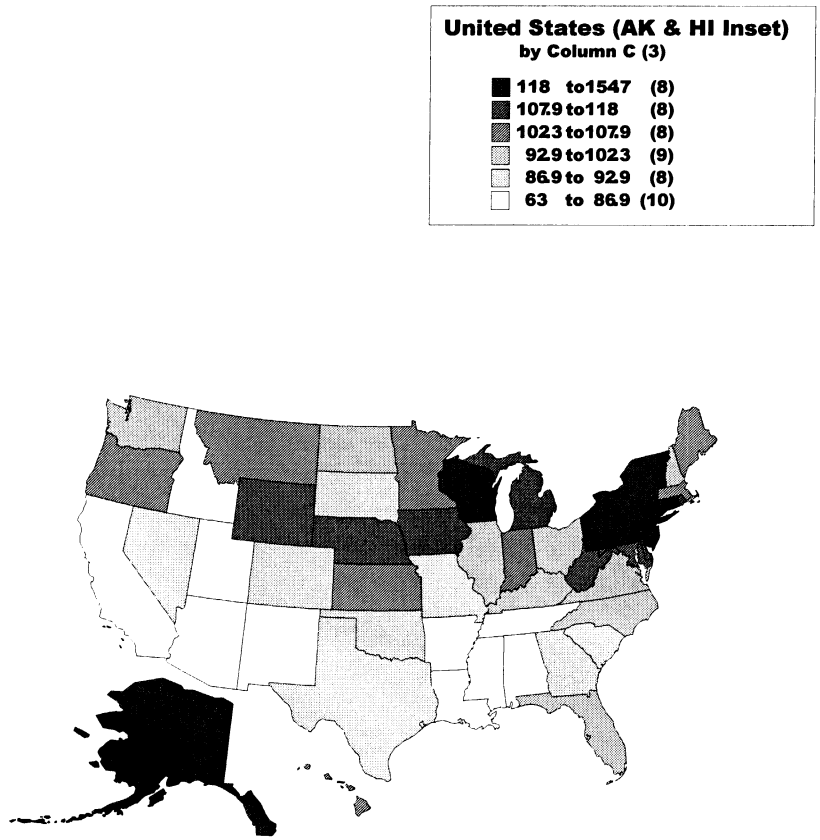
In addition to Utah, rounding out the lowest five spending states in 1987-88 were Mississippi, Idaho, Alabama, and Kentucky. As of 1993-94, Tennessee became one of the five lowest spending states, while Kentucky had made a considerable move out of that group. Indeed, by 1993-94, Kentucky had moved from 47th to 37th place. This significant movement follows a major educational reform that was enacted in Kentucky in 1990 and involved substantial injection of new funds into the educational system.

So far, the comparisons have all been in terms of actual current expenditures per pupil. But how do these comparisons change, if at all, when cost-adjusted expenditures are used for the analysis? That is, how do the real levels of school resources compare across states? Several comparisons are described below.

Changes in rankings due to cost adjustments. *How are rankings affected by adjusting for cost differences?* The answer to this question indicates the extent to which cost-adjusted figures tell a different story about inequality than unadjusted data. In 1987-88, nine states changed rankings by more than five places, either up or down, in moving from *actual* to *cost-adjusted* expenditures. *In the last two sample years (1990-91 and 1993-94), 16 and 15 states, respectively, changed rankings by more than five places as a result of applying cost-adjustments to the per pupil expenditure data.*

Index of real spending. Figure III-3 displays the index of *real* per pupil expenditure on educational services by state. The most densely shaded states are those with the highest indices of *real* spending. Other than Alaska and Wisconsin, the states with the highest *real* spending are in the northeastern United States. With the exception of Florida, states located in the South, Southwest, and Mountain regions are among the lowest spending states. Among the Western states, California exhibits the lowest level of *real* spending, while Oregon exhibits the highest level of *real* spending.

Figure III-3— Index of real spending by state, 1993-94



Source: The geographic cost-of-education indexes are based on statistical analyses of the patterns of differences in the wages and prices of school inputs. Data sources include the following: (a) Bureau of the Census: *Current Population Surveys, 1987- 1994;* 1990 Census of Governments, *Survey of Local Government Finances; County level census files*; (b) Bureau of Labor Statistics: *Producer Price Indices*-1985 - 1994 data; *Consumer Price Indices.* 1985 - 1994 data; (c) California Department of Education and Ohio Department of Education, databases on expenditures by object codes; (d) Geographic Names Information Systems (GNIS) CD-ROM (Latitudes and longitudes for most U.S. cities, towns and geographic locations; (e) *Higher education Research Institute at the Graduate School of Education*, Electronic database on SAT scores for entering Freshman, 1972, 1977, 1982 in approximately 2,300 colleges in the United States; (f) National Climatic Data Center and the National Center for Atmospheric Research, *The World Wealth Disc: Climate Data for the Planet Earth. CD-ROM*; (g) U.S. Department of Education, National Center for Education Statistics, *Common Core of Data; Schools and Staffing Survey;* 1990 Census School District Special Tabulation (summary file set I); (h) U.S. Federal Bureau of Investigation. (1995). The Uniform Crime Report (UCR), Return A, for the U.S. Washington, D.C.: U.S. Department of Justice. Cost indexes for certified personnel are estimated at the school district level. The statistical estimates underlying the cost indexes for non-certified school personnel are based on data for individuals identified by metropolitan area, though estimates of the index values are calculated estimated for counties and other smaller regions within metropolitan and non-metropolitan areas. See Chambers (1997) for details of the estimation techniques.

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Chapter IV

CONCLUSIONS

Specification Issues in Developing the GCEI: A Caveat

The development of the list of variables to be included in the statistical analysis of the costs of school personnel involves a combination of art and science. The science arises out of a formal conceptual framework that guides the variable selection process by hypothesizing certain specific relationships among dependent and independent variables. The art arises from the fact that the real world data available are not always commensurate with the desired theoretical measures.[32] Because of the nature of this process of variable selection, the same basic theoretical framework can lead to different empirical results due to the representation and measurement of the variables involved. Statistical analyses are always limited by the quality of the theoretical underpinnings which guide the analysis and the availability of data with which to measure the theoretical constructs.

A comparison of the previous work of Chambers (1995) on the development of the geographic teacher cost index (*subsequently referred to as the TCI95*) with the geographic teacher cost index arising out of the present project (*subsequently referred to as the TCI97*) provide one example of the impact of this process of variable selection. First, it should be noted that the *GCEI* developed in the present project is not being compared to the TCI because it represents much more than the TCI. The *GCEI* is a comprehensive cost-of-education index which encompasses the TCI (the teacher cost index) as well as indexes for school administrators and non-certified school personnel.[33]

Second, TCI97 includes some specific improvements in data that were not included in the previous analysis underlying the development of the TCI95. The analysis underlying the development of TCI97 includes differences among both the *discretionary* and *cost factors*.
TCI97 incorporates an additional measure of teacher quality, improved measurement of teacher experience, more accurate data on local crime rates (i.e., reflecting an estimated crime rate for the district as opposed to the county), a more sophisticated measure of labor market competitiveness (i.e., the Herfindahl index), and a control for the impact of collective bargaining. Unfortunately, because of the lack of more recent data on agricultural land values, TCI97 used data for all sample years on the median value of housing in the county to estimate the differences

[32] A more complete discussion of the process of variable selection may be found in Chambers (1981a).

[33] That is, the TCI97 is only one component that goes into the estimation of the overall GCEI.

in the base price of land.[34] Finally, it was decided to use continuous rather than discrete measures of many of the independent variables in the estimation of TCI97 than were used in the estimation of TCI95. For example, rather than using a series of dichotomous variables to reflect the level of violent crime, the present analysis included simply the crime rate (i.e., the number of violent crimes per 100,000 population) as an independent variable.

Because of all of these differences in empirical specification of the model, one would expect some differences in the estimates of the geographic cost indexes. At the same time, the basic pattern of cost differences is quite similar between these two studies. The overall correlation between the TCI97 and TCI95 is approximately 0.90.

The original analysis for TCI95 estimated both a regional as well as a district-level index. The present analysis did not include estimation of a regional index. Only a district-level index is estimated. Nevertheless, for the purpose of this comparison, both the regional and district-level index values for TCI95 are used for comparison. The district-level value is the one most comparable to the current analysis.

Table IV-1 illustrates the differences between TCI97 and TCI95 for the subset of districts enrolling 100,000 or more students. The *GCEI* is included in the table only as a point of reference. For this subset of districts, the TCI95 regional index is 0.5 percentage points smaller than the TCI97, while the TCI95 regional index is 1.7 percentage points larger on average than the TCI97 value. The absolute difference in the district-level values of the two indexes is 4.2 percentage points.

An analysis of all school districts indicates that the average value of the difference in index values between the TCI97 and the TCI95 is about -6.6 percentage points if one uses the regional version of TCI95 and about -2.4 percentage points if one uses the district version of TCI95. Some districts exhibit a higher and some a lower value of the TCI between the two specifications. In this case, the average district exhibits a TCI97 value that is 2.4 percentage points lower than the TCI95 value. If one looks at the absolute value of the difference, the average school district exhibits a TCI97 value which is about 8.7 percentage points different from the TCI95 regional index and about 5.6 percentage points different from the TCI95 district value. To some degree, this divergence between the two indexes provides an indication of the potential impact of differences in the specification of the model.

The same analysis was conducted on the state level weighted averages of these teacher cost indexes. The average state exhibited a difference of -0.23 percentage points: that is, the state- by-state average TCI97 was lower on average than the state-by-state average TCI95. The average absolute difference between the two indices is about 3.29 percentage points. The smaller average differences observed at the state level suggests that specification error tends to have a larger impact on indexes calculated at the district rather than the state level.[35] That is, specification error is smaller at the state level than the district level.

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[34] The value of agricultural land data used in the TCI95 analysis are available only for 1987, and it was felt it would be preferable to use data on the median value of housing for the county for 1990-91 for all three sample years for consistency.

[35] *Specification error* may be thought of as variations resulting from changing the specific measures or indicators of costs included in the statistical model.

Table IV-1— Comparison of the Teacher Cost Index from Chambers (1995) with the Teacher Cost Index from this study (sorted by state and enrollment within state)

tate	LEANAME	District Enrollment	*Teacher Cost Index TCI95* Regional	*TCI95* District	*TCI97* District	Difference between Task 2 & 34 Teacher Regional	Difference between Task 2 & 34 Teacher District	Squared Difference between Task 2 & 34 Teacher Regional	Squared Difference between Task 2 & 34 Teacher District	Absolute Difference between Task 2 & 34 Teacher Regional	Absolute Difference between Task 2 & 34 Teacher District
NY	NEW YORK CITY PUBLIC SCHOOLS	943,969	128.8	132.5	128.4	-0.4	-4.1	0.2	17.1	0.4	4.1
CA	LOS ANGELES UNIFIED	625,073	117.1	122.9	121.2	4.1	-1.7	16.8	2.9	4.1	1.7
IL	CITY OF CHICAGO SCHOOL DIST 29	408,830	118.9	120.7	110.5	-8.4	-10.2	70.3	103.2	8.4	10.2
FL	DADE COUNTY SCHOOL DISTRICT	292,000	101.1	103.6	106.5	5.4	2.9	28.8	8.6	5.4	2.9
TX	HOUSTON ISD	194,000	99.5	102.0	101.0	1.5	-1.1	2.1	1.2	1.5	1.1
PA	PHILADELPHIA CITY SCHOOL DIST	190,979	115.9	116.1	101.8	-14.2	-14.3	200.6	205.9	14.2	14.3
MI	DETROIT CITY SCHOOL DISTRICT	168,956	112.7	110.6	99.6	-13.1	-11.0	170.7	120.7	13.1	11.0
FL	BROWARD COUNTY SCHOOL DISTRICT	161,100	101.0	102.0	105.2	4.2	3.3	18.1	10.7	4.2	3.3
HI	HAWAII DEPT OF EDUCATION	159,285	92.5	107.2	99.4	6.9	-7.8	47.7	61.2	6.9	7.8
TX	DALLAS ISD	135,000	102.9	104.8	103.6	0.7	-1.2	0.5	1.5	0.7	1.2
VA	FAIRFAX COUNTY PUBLIC SCHOOLS	128,840	108.1	110.7	114.3	6.2	3.6	38.8	12.9	6.2	3.6
FL	HILLSBOROUGH COUNTY SCH DIST	123,900	98.4	99.3	96.2	-2.3	-3.1	5.1	9.6	2.3	3.1
NV	CLARK COUNTY SCHOOL DISTRICT	121,984	95.6	97.6	98.0	2.4	0.4	5.6	0.1	2.4	0.4
CA	SAN DIEGO CITY UNIFIED	121,107	109.0	114.9	115.1	6.1	0.2	37.0	0.1	6.1	0.2
FL	DUVAL COUNTY SCHOOL DISTRICT	111,100	91.2	91.4	94.1	2.9	2.7	8.3	7.3	2.9	2.7
MD	PRINCE GEORGES CO PUBLIC SCHS	108,868	104.8	104.5	103.4	-1.5	-1.2	2.1	1.3	1.5	1.2
MD	BALTIMORE CITY PUB SCH SYSTEM	108,663	111.6	109.9	104.2	-7.4	-5.7	55.1	32.6	7.4	5.7
TN	MEMPHIS CITY SCHOOL DISTRICT	107,103	94.1	92.8	95.1	1.0	2.3	1.0	5.1	1.0	2.3
FL	PALM BEACH COUNTY SCHOOL DIST	106,000	97.6	98.6	103.3	5.7	4.7	32.0	22.1	5.7	4.7
MD	MONTGOMERY CO PUBLIC SCHOOLS	103,757	104.9	108.1	108.3	3.4	0.3	11.8	0.1	3.4	0.3
FL	ORANGE COUNTY SCHOOL DISTRICT	103,000	93.3	94.4	100.3	7.0	5.8	48.5	33.8	7.0	5.8
						Average difference		Average deviation			
						0.5	-1.7	6.17707	5.597608	5.0	4.2
						0.5	-1.6	6.328832	5.661018	5.2	4.2

Source: The geographic cost-of-education indexes are based on statistical analyses of the patterns of differences in the wages and prices of school inputs. Data sources include the following: (a) Bureau of the Census: *Current Population Surveys, 1987- 1994;* 1990 Census of Governments, *Survey of Local Government Finances; County level census files*; (b) Bureau of Labor Statistics: *Producer Price Indices*-1985 - 1994 data; *Consumer Price Indices.* 1985 - 1994 data; (c) California Department of Education and Ohio Department of Education, databases on expenditures by object codes; (d) Geographic Names Information Systems (GNIS) CD-ROM (Latitudes and longitudes for most U.S. cities, towns and geographic locations; (e) *Higher education Research Institute at the Graduate School of Education*, Electronic database on SAT scores for entering Freshman, 1972, 1977, 1982 in approximately 2,300 colleges in the United States; (f) National Climatic Data Center and the National Center for Atmospheric Research, *The World Wealth Disc: Climate Data for the Planet Earth. CD-ROM*; (g) U.S. Department of Education, National Center for Education Statistics, *Common Core of Data; Schools and Staffing Survey;* 1990 Census School District Special Tabulation (summary file set I); (h) U.S. Federal Bureau of Investigation. (1995). The Uniform Crime Report (UCR), Return A, for the U.S. Washington, D.C.: U.S. Department of Justice. Cost indexes for certified personnel are estimated at the school district level. The statistical estimates underlying the cost indexes for non-certified school personnel are based on data for individuals identified by metropolitan area, though estimates of the index values are calculated estimated for counties and other smaller regions within metropolitan and non-metropolitan areas. See Chambers 1997 for details of the estimation techniques.

This analysis suggest that there is still much to be learned from continuing to refine the techniques for statistical estimation and the empirical specification of the model. In particular, further theoretical and empirical research needs to be done to improve the measures used to reflect the various factors that affect the supply of, and demand for, school personnel. One specific example is that we need to identify better and more widely available sources of data to measure the base price of land which is a major factor underlying differences in the cost of living across local jurisdictions. In the past, variables used include the value per acre of agricultural land and the median value of housing in the county (used in the current study).

Implications for Future Research

The geographic cost-of-education index provides a tool for educational researchers to use in future analyses of the variations in educational expenditures and resource allocation. It may be used to deflate expenditure information at the local level for more comprehensive analyses of the patterns of difference in the level of real resources available across local school districts. It may be used by individual states as a starting point for analyses of their own patterns of variation in costs and for considering methods for adjusting state grants-in-aid to local districts for such variations in costs. Researchers may also use the index as a tool in an effort to understand the impact of variations in resource costs on the patterns of demand for different school resources.

Future research efforts should refine the databases upon which these analyses are based, as well as the methodology and the empirical application of the GCEI to improve the measures that have been developed in this report. The following pages examine several areas for future research.

Improving data on fringe benefits. The analysis of certificated and noncertificated personnel presented in this report focuses entirely upon salaries and wages. To date, there have been no comprehensive studies suggesting what the impact of adding benefits to this analysis would be. If a high correlation exists between salaries, wages, and the value of benefits to employees, then the existing analysis of salaries may be sufficient. Unfortunately, benefit data are difficult to gather and incorporate into cost analyses.

Collection of benefit data requires a careful delineation of benefits (for example, health and major medical insurance) that are paid on a per employee basis versus those that are specified as a percentage of salary (for example, retirement, disability insurance, worker's compensation). In some instances, benefits are not necessarily paid by the district employing the individual, but rather are paid for by the state. For example, at one time the state of New York used to make payments to the retirement system on behalf of teachers, and the state of Kentucky currently provides a benefit package to certain categories of school personnel. While this may not be as important in comparing salaries within states, it is certainly important in conducting cross-state analyses of salaries and benefits.

Another complicating factor in the determination of benefits for school employees revolves around the differences in the contract year for various categories of school personnel. That is, some school district employees, such as teachers and instructional aides, are employed only for the academic year, while others, such as district-level administrators and certain categories of maintenance or support personnel, are employed year-round. For year-round employees, benefit calculations may require inclusion of vacation or other leave time.

Current fiscal data gathered by NCES are inadequate to the task for at least two reasons. First, NCES data do not accurately identify all of the benefit payments made on behalf of employees

(i.e., districts versus states). Second, NCES fiscal data do not distinguish between benefits paid per employee and those based on a percent of salary. This limitation distorts benefits for individuals making widely varying salaries even within the same job category.[36] NCES needs to address this issue through improved data gathering within *SASS* or its other fiscal data collection efforts.

Improved data on noncertificated school personnel. This report relies entirely upon samples of public and private employees derived from the *Current Population Surveys (CPS)*. One problem with the *CPS* data is that the samples of school personnel are not large enough to support the kind of analyses conducted in this study. It was necessary to include a wider range of individuals employed in the public and private sector and who had similar occupational categories as those commonly found in schools. The advantage of this approach is that it recognizes that these types of individuals are not unique to schools and that school districts must compete in a labor market that extends beyond that for school personnel. The disadvantage to using a wider sample of individuals is that the characteristics of individuals relevant for school district jobs are generally not available on a dataset like the *CPS*.

Perhaps the most significant problem with the *CPS* database is that it does not identify the county in which the individual resides or is employed. The database only identifies the metropolitan area within a state or the fact that the individual is located in any county outside a metropolitan area. This makes it impossible to assess variations in costs that might occur within metropolitan areas by county or within the vast numbers of nonmetropolitan counties within the United States. This limitation is clearly problematic for developing geographic cost- of-education indexes.

The NCES *Schools and Staffing Survey* may offer potential for collecting data on samples of certain categories of noncertificated school personnel for the purpose of improving the quality of information on patterns of wage variations across geographic jurisdictions.

Other categories of nonpersonnel costs. Nonpersonnel costs are another area for which there is little information. In general, analyses of nonpersonnel costs currently rely on creative solutions that make use of extant data sources or *ad hoc* decisions and assumptions about how these costs vary across geographic locations.

Measurement might well be improved by incorporating certain specific questions within existing data collection activities already in place at NCES. For example, as part of existing fiscal data collection efforts (e.g., the F-33 fiscal data collected by NCES), it would be possible to develop a list of specific nonpersonnel items commonly purchased by school districts and to ask for information from which average prices paid by local schools could be estimated. For example, information from a recent utility bill could be used to obtain energy prices, while invoices could be

[36] For example, consider two teachers in the same district: one earning $25,000 per year and the other earning $50,000 per year. Suppose that each is entitled to full medical coverage at a cost to the district of $5,000 per year per employee. In addition, assume the district contributes 12 percent of salary to a combination of retirement and other payroll taxes for each employee. Benefits for the teacher earning $25,000 per year amount to $8,000 per year (=$5,000 + .12 × $25,000), while benefits for the teacher earning $50,000 per year amount to $11,000 (=$5,000 + .12 × $50,000). In the first case, the benefit rate is 32 percent (=100 × $8,000 /$25,000), while in the second case, the benefit rate is 22 percent (=100 × $11,000/$50,000).

used to obtain the cost of textbooks. These data could then be used to estimate average prices across geographic locations.

The geographic location of a school district may affect the costs of nonpersonnel goods and contracted services purchased. Two specific dimensions of interest are the proximity of a district to the sources of nonpersonnel goods and services, and the effects of differences in climatic conditions across local districts. The proximity to points of production and service play a role by virtue of the variations in the costs of transporting certain goods and services to the local school district. That is, districts located in regions that are far removed from the point of production of a certain good will have to pay higher costs of transportation (freight costs) to obtain access to the item. This would be particularly true for the states of Alaska and Hawaii, where certain goods and contracted services must be shipped from the 48 contiguous states. However, these two states are not entirely unique in this respect as certain remote, rural districts in the 48 contiguous states are also subject to higher shipping costs. Some limited case studies and further data collection would help to assess how significant this issue is and for which districts.

Climatic differences across geographic locations also plays a potential role in understanding the patterns of variation in the costs of energy services across local school districts. The analysis in this report focuses only limited attention on energy costs as reflected in differences in the prices paid for natural gas and electricity in different regions of the United States. Previous experience working in this area suggests that variations in the costs of energy sources reflected in this analysis are much more limited than the reality would likely reveal.[37]

Beyond these differences in the prices of energy, one needs to account for the *variations in the levels of energy consumption required* to heat and cool school buildings to comfort levels (e.g., heating to 65 degrees in the winter and cooling to 72 degrees in the summer) or to achieve the required electrical power in specific types of buildings. Based on a previous study of energy requirements and costs in Alaska (Chambers and Parrish, 1984), energy costs exhibited a ratio of more than 13 to 1 between the highest and lowest cost districts. Only a part of this difference was due to differences in the prices of various energy sources (e.g., fuel oils versus public utility rates for natural gas). The remainder of the difference was associated with differences in the energy consumption requirements to achieve comfort levels. However, even within the lower 48 states, energy costs can exhibit substantial variations. For example, similar studies of energy prices and consumption were conducted in Illinois and California, and both of these states exhibited substantial patterns of variation in energy costs. In California, the ratio of the high to low cost indices for electrical power and natural gas were 2.5 to 1 and 31.6 to 1, respectively, while in Illinois the ratio of high to low energy costs (overall) were 3.6 to 1.[38]

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[37] See, for example, Chambers (1978b, 1982, 1984).

[38] The approach used in the California, Illinois, and Alaska projects simulates energy costs by building computer models of the energy requirements for school buildings according to the building codes, climatic conditions, and prices of energy sources in different regions of a state. All differences in energy expenditures in this type of model represent real cost differences in energy services.

A possible alternative approach would be an econometric analysis of energy expenditures across local jurisdictions that attempts to account for the extent of variation related to *cost factors*, such as the prices of alternative sources of energy services (e.g., public utilities, fuel oils) and climatic conditions. The problem is that such an analysis requires being able to control for differences in decisions to consume energy services across districts. Wealthy districts may be more extravagant in their consumption of energy services through choices of how buildings are constructed, how thermostats are regulated, or the availability and utilization of certain nonpersonnel items like computers.

Both of these factors could have potentially substantial impact on the overall variations in educational costs in states such as Alaska and Hawaii, as well as other states in the western and midwestern regions of the country where many school districts are located in remote regions and are subject to severe climatic conditions.

Home-to-school transportation costs. Another area in which geographic and demographic factors play a role in the costs of educational services is in the analysis of home-to-school transportation. Expenditures on these transportation services vary for a variety of reasons within the control of local school decisionmakers. For example, the district can set eligibililty criteria that affect the percentage of students transported to school: How far away from school does a child have to live to be eligible for transportation services? How does this distance vary with the age of the child or the program (e.g., special versus regular education) in which the child is enrolled? Other factors within the discretion of local decisionmakers include the types of vehicles purchased (e.g., size, fuel efficiency) and the effort spent in developing optimal bus routes. Whether a district offers transportation services to schools of choice within a magnet program will also affect the expenditures on transportation services.

However, several factors that affect the costs of home-to-school transportation services are beyond the control of local school officials. For example, the sparsity of student populations will affect the costs of home-to-school transportation: that is, more sparsely populated districts will face higher costs because of the greater distances that children must travel to get to school. If fewer children live within reasonable distances to school, a greater percentage will require transportation services.

Moreover, districts in areas with more severe climates will face higher costs due to costs of maintenance, capital costs of vehicles with severe weather capabilities, and differences in fuel efficiency associated with road conditions. Finally, the district size may affect transportation costs through economies of scale.

Transportation costs account for just in excess of 5.05 percent of the total current expenditures for educational services in the United States.[39] The percent of the budget allocated to home-to-school transportation ranges from about 1 to 9 percent across the 50 states and the District of Columbia. Expenditures per pupil *enrolled* range from a low of about $73 to a high of more than $530, with an average of about $264 per pupil.[40] This average, if expressed in terms of per pupil *transported*, would be equivalent to about $488 (=$264/0.54 where 0.54 = the average percent of pupils transported home-to-school in the United States).

A previous study of home-to-school transportation costs in Illinois showed costs ranging from $93 per pupil transported (1982 dollars) to $292 per pupil. A wider range of costs occurred in California and Alaska, where a wider range of transportation methods, including air travel, are used.

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[39] For state by state breakdowns of the expenditures on home-to-school transportation services see table D-3 in appendix D of the Technical Report (Chambers, 1997-III).

[40] These per pupil figures are based 1992-93 dollars and on pupils enrolled rather than pupils transported.

Problems in measuring cost differences and equity analysis. The cost issues that surround home-to-school transportation and energy services raise some significant questions for the analysis of equity. That is, should one include home-to-school transportation services or energy services in expenditure figures when examining differences in the levels of educational services across states or local jurisdictions? More often than not, home-to-school transportation services, or for that matter energy services, can be analyzed separately from other educational expenditures. Given the wide variation in the level of expenditure on transportation or energy services and the difficulty of controlling for the variations in the extent to which certain geographic or other factors might affect costs of services, inclusion of transportation or energy services may create a potential bias in the analysis of equity. Specifically, in remote and sparsely populated rural districts or in districts located in severe climatic regions, the inability to account for these cost differences in transportation and energy services may cause these districts to appear to have more resources devoted to educational services than they, in fact, do because of the high levels of expenditures on transportation costs. This could be a serious problem at a state level with a state such as Alaska.

The Next Frontier: Pupil Needs and Scale as *Cost Factors*

While substantial progress has been made in the development of cost adjustments in education, there is clearly much work left to be done. Better data are required to analyze the costs of noncertificated school personnel. Extensions of existing data collection activities could help in the analysis of certain nonpersonnel items. Case studies could provide some guidance on these elements, as well. Further work, perhaps involving engineering experts, could improve upon the analysis of energy costs and consumption patterns. And finally, more sophisticated econometric techniques could be applied to the analysis of home-to-school transportation costs to sort out the *cost* from the *discretionary factors*.

However, the biggest challenge still faces cost analysts. The next frontier in the arena of education cost analysis involves improving our understanding of the effects on educational service delivery of variations in the *educational needs of different student populations* and in the *scale of school and district operations*. While a true cost-of-education index requires a better assessment of the quality of educational services, it is even more true when assessing the impact of variations in pupil needs and scale of operations. Both of these dimensions require potentially significant differences in the way educational services are delivered. In the case of student needs, services to students with disabilities versus students with no disabilities may involve substantial differences in the combinations and configurations of school inputs. Similarly, services delivered in very small schools or districts in remote locations will be organized in very different ways from their suburban or large district counterparts. An obvious example may be found in the comparison of the one-room school house with the large city schools specializing in serving children of different ages or children with different educational objectives (for example, the vocational high school).

This continued work on costs is essential as NCES begins to explore the issues of productivity in education and recognizes the need to measure educational resource levels more accurately. Understanding productivity requires an understanding of the decisions that underlie the patterns of resource allocation in local school systems, and understanding these patterns requires a comprehensive understanding of the patterns of variation in the factors that affect the costs of educational services.

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Number	Title	Contact
94-01 (July)	Schools and Staffing Survey (SASS) Papers Presented at Meetings of the American Statistical Association	Dan Kasprzyk
94-02 (July)	Generalized Variance Estimate for Schools and Staffing Survey (SASS)	Dan Kasprzyk
94-03 (July)	1991 Schools and Staffing Survey (SASS) Reinterview Response Variance Report	Dan Kasprzyk
94-04 (July)	The Accuracy of Teachers' Self-reports on their Postsecondary Education: Teacher Transcript Study, Schools and Staffing Survey	Dan Kasprzyk
94-05 (July)	Cost-of-Education Differentials Across the States	William Fowler
94-06 (July)	Six Papers on Teachers from the 1990-91 Schools and Staffing Survey and Other Related Surveys	Dan Kasprzyk
94-07 (Nov.)	Data Comparability and Public Policy: New Interest in Public Library Data Papers Presented at Meetings of the American Statistical Association	Carrol Kindel
95-01 (Jan.)	Schools and Staffing Survey: 1994 Papers Presented at the 1994 Meeting of the American Statistical Association	Dan Kasprzyk
95-02 (Jan.)	QED Estimates of the 1990-91 Schools and Staffing Survey: Deriving and Comparing QED School Estimates with CCD Estimates	Dan Kasprzyk
95-03 (Jan.)	Schools and Staffing Survey: 1990-91 SASS Cross-Questionnaire Analysis	Dan Kasprzyk
95-04 (Jan.)	National Education Longitudinal Study of 1988: Second Follow-up Questionnaire Content Areas and Research Issues	Jeffrey Owings
95-05 (Jan.)	National Education Longitudinal Study of 1988: Conducting Trend Analyses of NLS-72, HS&B, and NELS:88 Seniors	Jeffrey Owings

Listing of NCES Working Papers to Date--Continued

Number	Title	Contact
95-06 (Jan.)	National Education Longitudinal Study of 1988: Conducting Cross-Cohort Comparisons Using HS&B, NAEP, and NELS:88 Academic Transcript Data	Jeffrey Owings
95-07 (Jan.)	National Education Longitudinal Study of 1988: Conducting Trend Analyses HS&B and NELS:88 Sophomore Cohort Dropouts	Jeffrey Owings
95-08 (Feb.)	CCD Adjustment to the 1990-91 SASS: A Comparison of Estimates	Dan Kasprzyk
95-09 (Feb.)	The Results of the 1993 Teacher List Validation Study (TLVS)	Dan Kasprzyk
95-10 (Feb.)	The Results of the 1991-92 Teacher Follow-up Survey (TFS) Reinterview and Extensive Reconciliation	Dan Kasprzyk
95-11 (Mar.)	Measuring Instruction, Curriculum Content, and Instructional Resources: The Status of Recent Work	Sharon Bobbitt & John Ralph
95-12 (Mar.)	Rural Education Data User's Guide	Samuel Peng
95-13 (Mar.)	Assessing Students with Disabilities and Limited English Proficiency	James Houser
95-14 (Mar.)	Empirical Evaluation of Social, Psychological, & Educational Construct Variables Used in NCES Surveys	Samuel Peng
95-15 (Apr.)	Classroom Instructional Processes: A Review of Existing Measurement Approaches and Their Applicability for the Teacher Follow-up Survey	Sharon Bobbitt
95-16 (Apr.)	Intersurvey Consistency in NCES Private School Surveys	Steven Kaufman
95-17 (May)	Estimates of Expenditures for Private K-12 Schools	Stephen Broughman
95-18 (Nov.)	An Agenda for Research on Teachers and Schools: Revisiting NCES' Schools and Staffing Survey	Dan Kasprzyk
96-01 (Jan.)	Methodological Issues in the Study of Teachers' Careers: Critical Features of a Truly Longitudinal Study	Dan Kasprzyk

Listing of NCES Working Papers to Date--Continued

Number	Title	Contact
96-02 (Feb.)	Schools and Staffing Survey (SASS): 1995 Selected papers presented at the 1995 Meeting of the American Statistical Association	Dan Kasprzyk
96-03 (Feb.)	National Education Longitudinal Study of 1988 (NELS:88) Research Framework and Issues	Jeffrey Owings
96-04 (Feb.)	Census Mapping Project/School District Data Book	Tai Phan
96-05 (Feb.)	Cognitive Research on the Teacher Listing Form for the Schools and Staffing Survey	Dan Kasprzyk
96-06 (Mar.)	The Schools and Staffing Survey (SASS) for 1998-99: Design Recommendations to Inform Broad Education Policy	Dan Kasprzyk
96-07 (Mar.)	Should SASS Measure Instructional Processes and Teacher Effectiveness?	Dan Kasprzyk
96-08 (Apr.)	How Accurate are Teacher Judgments of Students' Academic Performance?	Jerry West
96-09 (Apr.)	Making Data Relevant for Policy Discussions: Redesigning the School Administrator Questionnaire for the 1998-99 SASS	Dan Kasprzyk
96-10 (Apr.)	1998-99 Schools and Staffing Survey: Issues Related to Survey Depth	Dan Kasprzyk
96-11 (June)	Towards an Organizational Database on America's Schools: A Proposal for the Future of SASS, with comments on School Reform, Governance, and Finance	Dan Kasprzyk
96-12 (June)	Predictors of Retention, Transfer, and Attrition of Special and General Education Teachers: Data from the 1989 Teacher Followup Survey	Dan Kasprzyk
96-13 (June)	Estimation of Response Bias in the NHES:95 Adult Education Survey	Steven Kaufman
96-14 (June)	The 1995 National Household Education Survey: Reinterview Results for the Adult Education Component	Steven Kaufman

Listing of NCES Working Papers to Date--Continued

Number	Title	Contact
96-15 (June)	Nested Structures: District-Level Data in the Schools and Staffing Survey	Dan Kasprzyk
96-16 (June)	Strategies for Collecting Finance Data from Private Schools	Stephen Broughman
96-17 (July)	National Postsecondary Student Aid Study: 1996 Field Test Methodology Report	Andrew G. Malizio
96-18 (Aug.)	Assessment of Social Competence, Adaptive Behaviors, and Approaches to Learning with Young Children	Jerry West
96-19 (Oct.)	Assessment and Analysis of School-Level Expenditures	William Fowler
96-20 (Oct.)	1991 National Household Education Survey (NHES:91) Questionnaires: Screener, Early Childhood Education, and Adult Education	Kathryn Chandler
96-21 (Oct.)	1993 National Household Education Survey (NHES:93) Questionnaires: Screener, School Readiness, and School Safety and Discipline	Kathryn Chandler
96-22 (Oct.)	1995 National Household Education Survey (NHES:95) Questionnaires: Screener, Early Childhood Program Participation, and Adult Education	Kathryn Chandler
96-23 (Oct.)	Linking Student Data to SASS: Why, When, How	Dan Kasprzyk
96-24 (Oct.)	National Assessments of Teacher Quality	Dan Kasprzyk
96-25 (Oct.)	Measures of Inservice Professional Development: Suggested Items for the 1998-1999 Schools and Staffing Survey	Dan Kasprzyk
96-26 (Nov.)	Improving the Coverage of Private Elementary-Secondary Schools	Steven Kaufman
96-27 (Nov.)	Intersurvey Consistency in NCES Private School Surveys for 1993-94	Steven Kaufman

Listing of NCES Working Papers to Date--Continued

Number	Title	Contact
96-28 (Nov.)	Student Learning, Teaching Quality, and Professional Development: Theoretical Linkages, Current Measurement, and Recommendations for Future Data Collection	Mary Rollefson
96-29 (Nov.)	Undercoverage Bias in Estimates of Characteristics of Adults and 0- to 2-Year-Olds in the 1995 National Household Education Survey (NHES:95)	Kathryn Chandler
96-30 (Dec.)	Comparison of Estimates from the 1995 National Household Education Survey (NHES:95)	Kathryn Chandler
97-01 (Feb.)	Selected Papers on Education Surveys: Papers Presented at the 1996 Meeting of the American Statistical Association	Dan Kasprzyk
97-02 (Feb.)	Telephone Coverage Bias and Recorded Interviews in the 1993 National Household Education Survey (NHES:93)	Kathryn Chandler
97-03 (Feb.)	1991 and 1995 National Household Education Survey Questionnaires: NHES:91 Screener, NHES:91 Adult Education, NHES:95 Basic Screener, and NHES:95 Adult Education	Kathryn Chandler
97-04 (Feb.)	Design, Data Collection, Monitoring, Interview Administration Time, and Data Editing in the 1993 National Household Education Survey (NHES:93)	Kathryn Chandler
97-05 (Feb.)	Unit and Item Response, Weighting, and Imputation Procedures in the 1993 National Household Education Survey (NHES:93)	Kathryn Chandler
97-06 (Feb.)	Unit and Item Response, Weighting, and Imputation Procedures in the 1995 National Household Education Survey (NHES:95)	Kathryn Chandler
97-07 (Mar.)	The Determinants of Per-Pupil Expenditures in Private Elementary and Secondary Schools: An Exploratory Analysis	Stephen Broughman
97-08 (Mar.)	Design, Data Collection, Interview Timing, and Data Editing in the 1995 National Household Education Survey	Kathryn Chandler

Listing of NCES Working Papers to Date--Continued

Number	Title	Contact
97-09 (Apr.)	Status of Data on Crime and Violence in Schools: Final Report	Lee Hoffman
97-10 (Apr.)	Report of Cognitive Research on the Public and Private School Teacher Questionnaires for the Schools and Staffing Survey 1993-94 School Year	Dan Kasprzyk
97-11 (Apr.)	International Comparisons of Inservice Professional Development	Dan Kasprzyk
97-12 (Apr.)	Measuring School Reform: Recommendations for Future SASS Data Collection	Mary Rollefson
97-13 (Apr.)	Improving Data Quality in NCES: Database-to-Report Process	Susan Ahmed
97-14 (Apr.)	Optimal Choice of Periodicities for the Schools and Staffing Survey: Modeling and Analysis	Steven Kaufman
97-15 (May)	Customer Service Survey: Common Core of Data Coordinators	Lee Hoffman
97-16 (May)	International Education Expenditure Comparability Study: Final Report, Volume I	Shelley Burns
97-17 (May)	International Education Expenditure Comparability Study: Final Report, Volume II, Quantitative Analysis of Expenditure Comparability	Shelley Burns
97-18 (June)	Improving the Mail Return Rates of SASS Surveys: A Review of the Literature	Steven Kaufman
97-19 (June)	National Household Education Survey of 1995: Adult Education Course Coding Manual	Peter Stowe
97-20 (June)	National Household Education Survey of 1995: Adult Education Course Code Merge Files User's Guide	Peter Stowe
97-21 (June)	Statistics for Policymakers or Everything You Wanted to Know About Statistics But Thought You Could Never Understand	Susan Ahmed
97-22 (July)	Collection of Private School Finance Data: Development of a Questionnaire	Stephen Broughman

Listing of NCES Working Papers to Date--Continued

Number	Title	Contact
97-23 (July)	Further Cognitive Research on the Schools and Staffing Survey (SASS) Teacher Listing Form	Dan Kasprzyk
97-24 (Aug.)	Formulating a Design for the ECLS: A Review of Longitudinal Studies	Jerry West
97-25 (Aug.)	1996 National Household Education Survey (NHES:96) Questionnaires: Screener/Household and Library, Parent and Family Involvement in Education and Civic Involvement, Youth Civic Involvement, and Adult Civic Involvement	Kathryn Chandler
97-26 (Oct.)	Strategies for Improving Accuracy of Postsecondary Faculty Lists	Linda Zimbler
97-27 (Oct.)	Pilot Test of IPEDS Finance Survey	Peter Stowe
97-28 (Oct.)	Comparison of Estimates in the 1996 National Household Education Survey	Kathryn Chandler
97-29 (Oct.)	Can State Assessment Data be Used to Reduce State NAEP Sample Sizes?	Steven Gorman
97-30 (Oct.)	ACT's NAEP Redesign Project: Assessment Design is the Key to Useful and Stable Assessment Results	Steven Gorman
97-31 (Oct.)	NAEP Reconfigured: An Integrated Redesign of the National Assessment of Educational Progress	Steven Gorman
97-32 (Oct.)	Innovative Solutions to Intractable Large Scale Assessment (Problem 2: Background Questionnaires)	Steven Gorman
97-33 (Oct.)	Adult Literacy: An International Perspective	Marilyn Binkley
97-34 (Oct.)	Comparison of Estimates from the 1993 National Household Education Survey	Kathryn Chandler
97-35 (Oct.)	Design, Data Collection, Interview Administration Time, and Data Editing in the 1996 National Household Education Survey	Kathryn Chandler
97-36 (Oct.)	Measuring the Quality of Program Environments in Head Start and Other Early Childhood Programs: A Review and Recommendations for Future Research	Jerry West

Listing of NCES Working Papers to Date--Continued

Number	Title	Contact
97-37 (Nov.)	Optimal Rating Procedures and Methodology for NAEP Open-ended Items	Steven Gorman
97-38 (Nov.)	Reinterview Results for the Parent and Youth Components of the 1996 National Household Education Survey	Kathryn Chandler
97-39 (Nov.)	Undercoverage Bias in Estimates of Characteristics of Households and Adults in the 1996 National Household Education Survey	Kathryn Chandler
97-40 (Nov.)	Unit and Item Response Rates, Weighting, and Imputation Procedures in the 1996 National Household Education Survey	Kathryn Chandler
97-41 (Dec.)	Selected Papers on the Schools and Staffing Survey: Papers Presented at the 1997 Meeting of the American Statistical Association	Steve Kaufman
97-42 (Jan. 1998)	Improving the Measurement of Staffing Resources at the School Level: The Development of Recommendations for NCES for the Schools and Staffing Survey (SASS)	Mary Rollefson
97-43 (Dec.)	Measuring Inflation in Public School Costs	William J. Fowler, Jr.
97-44 (Dec.)	Development of a SASS 1993-94 School-Level Student Achievement Subfile: Using State Assessments and State NAEP, Feasibility Study	Michael Ross
98-01 (Jan.)	Collection of Public School Expenditure Data: Development of a Questionnaire	Stephen Broughman
98-02 (Jan.)	Response Variance in the 1993-94 Schools and Staffing Survey: A Reinterview Report	Steven Kaufman
98-03 (Feb.)	Adult Education in the 1990s: A Report on the 1991 National Household Education Survey	Peter Stowe
98-04 (Feb.)	Geographic Variations in Public Schools' Costs	William J. Fowler, Jr.