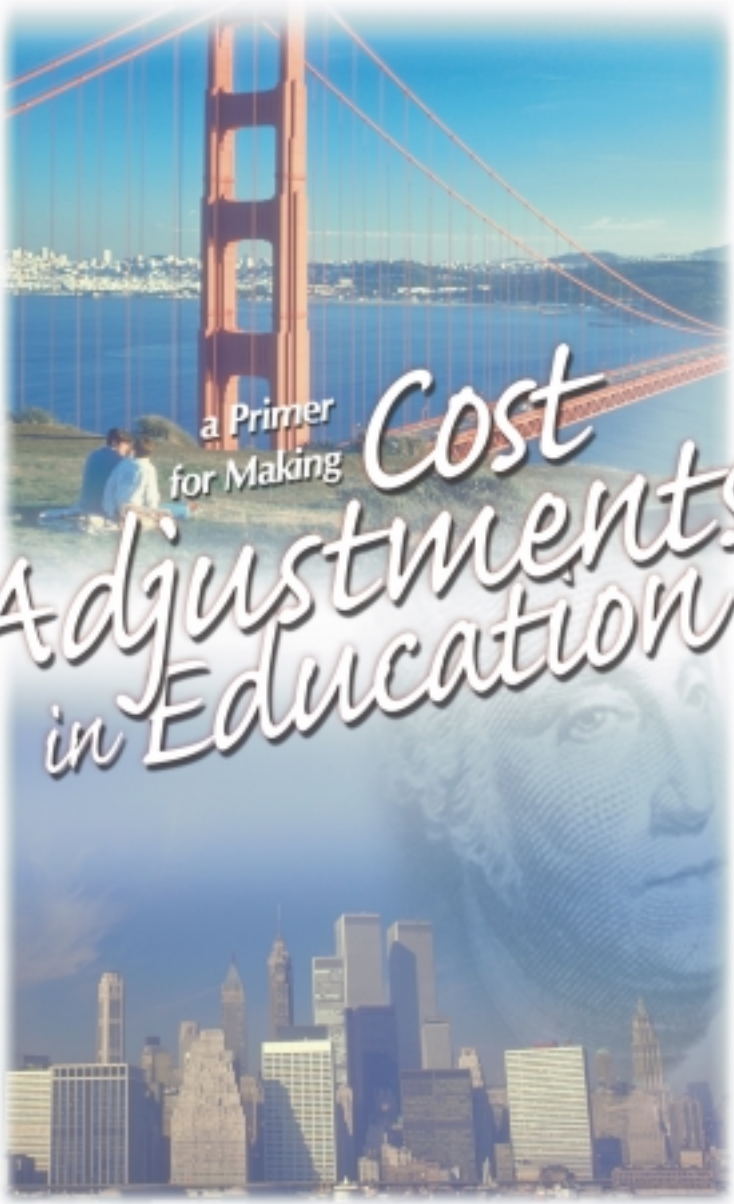
NATIONAL CENTER FOR EDUCATION STATISTICS

Research and Development Report February 2001



U.S. Department of Education
Office of Educational Research and Improvement

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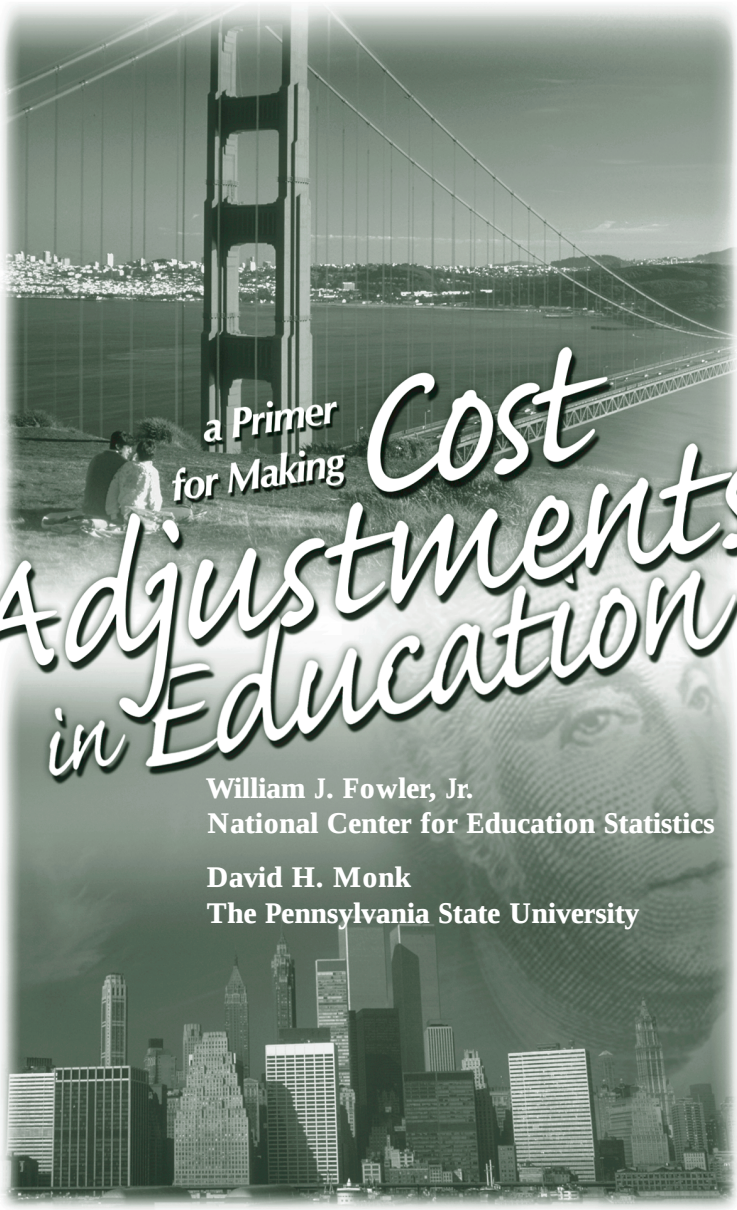

a Primer for Making Cost Adjustments in Education

William J. Fowler, Jr.
National Center for Education Statistics

David H. Monk
The Pennsylvania State University

U.S. Department of Education
Office of Educational Research and Improvement

NCES 2001–323

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Content Contact:
William J. Fowler, Jr.
202–502–7338 or e-mail: William_Fowler@ed.gov

Dedication

In 1974, Harvey E. Brazer and Ann P. Anderson published *Adjusting for Differences among School Districts in the Costs of Educational Inputs: A Feasibility Report*. It was among the first econometric works to explore the extent to which costs vary among school districts, contending that neither an equal dollar distribution of funds nor an equal-yield per unit of tax effort can achieve equality of educational inputs or the capacity to acquire them. The work developed a "pilot" adjustment index that measured the influence on teachers' salaries of factors that affect both the demand for teachers and their supply. The index was designed in such a fashion that, when applied to the initial amount of dollars available, the product of the index and that initial amount will be a sum sufficient to permit all districts to acquire the same quantity of teacher inputs. The approach, in effect, neutralized differences in demand among districts and compensated for differences in supply conditions facing districts. The authors concluded that the methodology suggested in the paper was capable of providing appropriate guidelines for adjusting dollars per pupil in order to compensate for price differences in teacher salaries.

The cost adjustment work we review in this book borrows greatly from the insights of this 1974 work by Harvey. We, as authors, wish to acknowledge his contribution by dedicating this book to his memory.

Harvey E. Brazer was born in Montreal in 1922. He received his bachelor's degree from McGill University in 1943 and his Ph.D. in Economics from Columbia University in 1951. He spent the bulk of his career in the Department of

Economics at the University of Michigan, beginning in 1957, following several years on the faculty of Wayne State University. He served as Deputy Assistant Secretary and Director, Office of Tax Analysis, U.S. Treasury during the Kennedy administration. His extensive contributions to the economics profession, both within and outside of the academy, include dozens of published monographs and articles, many positions as a consultant to national, state, and local study and advisory commissions, director of state tax studies, and a consultant to the Federal Reserve Board and the Council of Economic Advisors. His work on "municipal overburden" with Therese McCarty is still a classic in the field of education. Following his retirement from the University of Michigan in 1986, he headed a tax reform project in Grenada.

We were all saddened to learn of the aggressive cancer that quickly claimed his life. He passed away in 1991, at the age of 69.

Harvey and his wife, Marjorie Cohn Brazer, had three children, Mara, Karen, and David. Harvey and Marj were avid sailors, spending summer months on their yacht, the *Etude*, cruising the Great Lakes (requiring his students and colleagues to learn to use marine radio, and suffer periods when he was unreachable.) Harvey did not suffer fools or foolish policy measures gladly. Graduate students referred to him as "Blunt-speak Brazer." His candor, though, was coupled with a warm sense of humor and a dedication to high-quality education. Harvey emphasized perspective, frequently reminding others to ask, "How much does this really matter?" It is a question all of us should contemplate, particularly when using cost adjustments in education.

William J. Fowler, Jr.
David H. Monk

Foreword

Cost adjustments for different geographic locations and for inflation are widely accepted and applied outside of elementary and secondary education. Virtually everyone has heard of the Consumer Price Index (CPI), published by the U.S. Department of Labor, Bureau of Labor Statistics, as an inflation measure. So widespread is the public knowledge of this index that it is often included in labor contracts as a measure of inflation. In addition, the public is also aware of cost-of-living differences between major metropolitan areas, and its effect on attracting workers to more expensive living areas usually involves additional compensation.

Many educators, however, have not yet chosen to implement either geographic or inflation education cost adjustments. Nonadoption of cost adjustments may be the result of there being a plethora of competing methodological approaches with complex mixes of advantages and disadvantages of each. In addition, cost adjustments may not be beneficial to all parties, and substantial opposition can surface from a constituency that would be disadvantaged by adopting a particular type of adjustment. Because there may not be a single best cost adjustment, it is important to share the approaches that have been utilized, examining the strengths and weaknesses of each.

The National Center for Education Statistics (NCES) had the authors undertake this book so that educators, the public, and policymakers might better understand both geographic and inflation adjustments, and how they might be applied to education. Along the way, the authors seek to inform these audiences of the differences in expenditures

and costs, and on how both geographic and inflation education cost adjustments can be used to assist in differentiating nominal and real costs. The authors are particularly concerned with approaches, techniques, and adjustments that may either not be appropriate for measuring costs in education, or that are inappropriately applied. In addition, they attempt to show that there is a real virtue to keeping cost adjustment indices as simple and understandable as possible.

Because this work presents the view of the authors, and is intended to promote the exchange of ideas among researchers and policymakers, no official support by the U.S. Department of Education or NCES is intended or should be inferred.

Jeffrey A. Owings, Associate Commissioner
Elementary/Secondary and Libraries Studies Division

Preface

The research and development (R&D) series of reports was initiated for three reasons. First, to share studies and research that are developmental in nature. The results of such studies may be revised as the work continues and additional data become available. Second, to share the results of studies that are, to some extent, on the "cutting edge" of methodological developments. Emerging analytical approaches and new computer software development often permits new, and sometimes controversial analysis to be done. By participating in "frontier research" we hope to contribute to the resolution of issues and improve analysis. Finally, to participate in discussions of emerging issues of interest to educational researchers, statisticians, and the federal statistical community in general. Such reports may document workshops and symposiums sponsored by the National Center for Education Statistics (NCES) that address methodological and analytical issues, or may share and discuss issues regarding NCES practice, procedure, and standards.

The common theme in these goals is the fact that the reports present results or discussions that do not reach definitive conclusions at this point in time, either because the data are tentative, the methodology is new and developing, or the topic is one on which there are divergent views. Therefore, the techniques and inferences made from the data are tentative and are subject to revision. To facilitate the process of closure on the issues, we invite comments, criticism, and alternatives to what we have done.

Marilyn M. McMillen, Chief Statistician
Statistical Standards Program

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The authors gratefully acknowledges the comments and suggestions of the reviewers: James Guthrie, Vanderbilt University; Dominic Brewer, Rand Education; F. Howard Nelson, American Federation of Teachers; Nancy Protheroe, Educational Research Service; Philip Kearney, professor emeritus, University of Michigan. From the U.S. Department of Education: Stephanie Stullich, Planning and Evaluation Service; James Houser, Office of the Deputy Secretary/Budget Services; Judith Holt, OSERS; Kimberly Jenkins, OGC; Mary Schifferli, OCR. From the National Center for Education Statistics (NCES): William Hussar, Frank Johnson, and Andrew Kolstad. In addition, Michael Cohen, formerly of NCES, and Leslie Scott, from Education Statistical Services Institute, reviewed and adjudicated this manuscript. We also would like to acknowledge the contributions of the following individuals from Pinkerton Computer Consultants, Inc.: Carol Rohr coordinated with each author to receive all materials and to resolve editorial issues; Ross Pfile, Sonia Connor, and Rebecca Pratt edited the manuscript; and Allison Pinckney, Mark Ricks, and Carol Rohr designed the layout, performed the desktop publishing, and prepared the files for printing, and Mark Ricks designed the cover.

Executive Summary

Most people intuitively recognize geographic differences in costs and in measuring inflation. Efforts to compare the costs of exactly the same things in different geographic regions involve comparisons of the same "market basket" of goods in two geographic areas. The difference in the prices of the same market basket of goods is designed to reveal the differences in the geographic cost of living. Measuring cost differences in education, however, is difficult, since most of the costs are in personnel, rather than in supplies. In this publication, the authors attempt to explain the differences between educational costs and expenditures, explain the differences in the "unit price" of teachers and differences over time in the level of inflation, examine existing indices that can be used to make judgments for these differences in costs, and outline a future plan of action to derive a precise, stable, and accurate index for school administrators and policymakers to use.

The Difference Between Cost and Expenditure

The cost of education can be defined as the minimum of what must be given up to accomplish some result. "Expenditure" is different from "cost" in that expenditures are not tied to results or outcomes and can exceed the minimum of what must be given up.

Costs can be organized according to an allocation hierarchy where the lowest level is the unit cost of various inputs like teachers' time, space, and supplies. At the next level, there are costs that occur as the individual inputs are combined to form educational services within classrooms and schools. Finally, at the uppermost level are the actual out-

comes of schooling where costs occur because of the presence of students with specialized needs of various kinds. Resource allocation decisions are made at each of these levels, and it is useful to keep them distinct because this can allow us to determine the relative magnitude of each source of cost.

Geographically Based Cost Adjustments

The purpose of a Geographically Based Teacher Price Index is to determine the relative cost of engaging the services of comparable teachers. Some of the necessary components include: teacher characteristics (level of experience, training, minority status, gender), cost of living adjustments, regional amenities, employment amenities, nonteaching wages and employment opportunities in the region, union and collective bargaining, and demand for teacher quality. Several scholars have attempted to define a Geographically Based Index. The Teacher Attribute Model is the result of Stephen Barro's (1994) approach. Barro did not strive to include all of the components outlined above in order to keep the number of assumptions based on incomplete data low. His estimate focuses on interstate comparisons and estimates what each state's average teacher's salary would be if the state employed teachers with the same average experience and training as that found in the Nation as a whole.

Another approach has been characterized by Walter McMahon and colleagues (1996) as the "market-basket" approach. This approach does not focus on school personnel but rather on costs that are outside of the school's control such as wages in other sectors of the economy and geographically-based differences in the cost of living. One reason for this focus is to prevent a feedback loop rewarding schools that increased salaries. The basic factors in this

model are the value of housing, per capita income, the percent change in population for the preceding decade and variables representing regions of the country. It can predict cost-of-living indices at several levels of aggregation.

The hedonic model (Chambers 1998) is a more ambitious approach that deals explicitly with each of the influences listed above. The model is called "hedonic" because it is sensitive to whatever it is that teachers find attractive or repelling about a given career opportunity. The Teacher Cost Index (Chambers and Fowler 1995) is an example of this approach. Using Schools and Staffing Survey (SASS) data, it includes teacher characteristics (ethnicity, gender, education, and experience), working conditions (class size), and salary information. Other data sources were used to assess the regional amenities. Cost influences that the school has control over were statistically controlled while other influences were allowed to vary. The Geographic Cost-of-Education index (Chambers 1998) is a more recent application of this approach. In this model the index was broadened to include other types of inputs (school administrators, noncertified school personnel, nonpersonnel) and widened the range of data sources. Both approaches run the risk of relying too much on potentially questionable data sources and assumptions.

The production function models are perhaps the most ambitious by focusing on the costs associated with actually realizing gains in educational performance. Unfortunately there is a lack of adequate data and complete theoretical specification for this model to have widespread use in practice. However, in recent years this model has been applied to several states. For an example, see the application to New York (Duncombe, Ruggiero, and Yinger 1996). There also have been applications to Wisconsin and Texas.

A comparison of the three main models (Barro, McMahon and Chang, and Chambers and Fowler) demonstrates that the indices are highly correlated at over .70. Also, the more adjustments are made, the more the degree of variation drops. Despite the high correspondence between these indices, there are certain regions where there is disagreement between the indices. A comparison between the hedonic model and the cost-of-living model may indicate that this discrepancy is due to the region's attractiveness (such as San Francisco) or unattractiveness (such as nonmetropolitan Connecticut) to most teachers.

Cost Adjustments Over Time

Adjusting for regional cost-of-living differences is only one of the challenges to producing a cost-of-education index. The other major challenge involves adjusting for cost-of-living differences over time. Different deflators can lead researchers to difference conclusions.

The most common way of measuring inflation is the method used by the Consumer Price Index (CPI) where the cost of commonly purchased items is tracked over time. The School Price Index is one example of this method, that uses the Urban component of the CPI, the CPI-U. Unfortunately, this index can only be used at the national level. There are many problems with applying the CPI approach to education, especially the change of relevant products over time (item substitution) and the uneven growth of inflation for different occupational areas. Education is one of those occupations that has been strongly influenced by changes in technology. This makes it difficult to track inflation since the supplies bought today (such as the computer or VCR) are not really comparable to the supplies of a few decades ago (such as the typewriter or projector). The second problem is that some areas have seen strong inflation (such as

medicine) while other areas have not. Rothstein and Mishel (1997) argue that due to factors such the increase in quality due to smaller teacher/student ratios have made inflation greater for education. Their solution is to use the Net Services Index (NSI), which measures inflation by focusing on labor-intensive components of the CPI similar to education. However, they acknowledge that while the NSI is an improvement, it is still an underestimate.

A second approach, the Inflationary Cost-of-Education Index (ICEI) modifies the hedonic TCI to include school administrators and noncertified staff. However, given data limitations this only provides a 6-year inflation index during the years SASS was administered.

The Employment Cost Index (ECI) also avoids the market-basket approach by measuring the rate of change in employee compensation, which includes wages, salaries and employer's costs for employee's benefits. It covers all occupations with the exception of federal government workers, and is used extensively by the Federal Reserve Board as a measure of inflation. It has an education subscale and has separate data on salaries as well as fringe benefits. Of all of the indices, this one is the most attractive because it avoids the pitfalls of item substitution found in the market-basket approach and has a large time frame (1981 to 1996) available.

Using Geographic and Inflation Deflators

Both geographic and inflation cost adjustments suffer from many flaws. Overall there is correspondence between different geographic indices, however for a particular area the results can be dramatically different. Given the political nature of these adjustments, such discrepancies can be as problematic as they are informative. While the addition of

more adjustments leads to a reduction of variability and arguably greater accuracy, the policymakers' reluctance to use adjustments is understandable.

Lessons to Learn and Directions for Future Work

There are two primary goals for the future of Geographic Cost Adjustments: improve the index of cost variations as well as educate the public and policymakers about any progress that is made. The basic challenges are: make the indices generalizeable across different levels (local, state, and region), separate and distinguish influences that are controllable by the school, be careful of double counting when adding new adjustments, and address any political considerations.

Advice for next steps:

1. Keep the indices as simple and understandable as possible.

2. Strive to reach consensus about how ambitious you wish to be with respect to cost adjustments in full knowledge of the flaws that remain in the available tools.

3. Keep in mind that not all adjustments are beneficial to all parties. Be particularly wary of flawed adjustments that benefit one set of political interests over others.

4. Provide for gradual phase-ins. Consider "quasi-leveling up" strategies and take advantage of inflation.

5. Place primary emphasis on supporting the further improvement of the available indices.

A more sophisticated index will allow policymakers to more accurately identify what costs are the results of regional differences and what changes in costs over time are the result of different decisions and factors. This will allow a more efficient allocation of educational resources. Both the public and policymakers need to be informed of progress made in this area so the index can be better utilized and a consensus can be reached on the appropriate approach.

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Chapter 1. Introduction

Most people intuitively recognize geographic differences in costs. For example, the median 1990 price of housing in the Edgemont school district in downstate New York was about $462,081, while the median price of housing in the Watervliet City school district in upstate New York (near Albany) was about $81,891.[1] Many states show this kind of geographic cost difference between "upstate" and "downstate." In addition, there are pronounced differences across the United States in the cost of living, from coast to coast, from either coast to the Mississippi River, and from the Great Lakes to the Gulf of Mexico.

While housing values are the most commonly cited example of differences in geographic cost differences, they are a poor illustration because the price of housing is as much a component of the size, quality, design, and features of each house as it is of geographic cost differences.

[1] These figures were obtained from the National Center for Education Statistics (NCES) School District Mapping Project, which took 1990 decennial Census information and mapped it to school district boundaries.

Therefore, simply comparing the two median prices does not reveal the differences in the cost of two identically similar houses. Efforts to compare the costs of exactly the same things in different geographic regions involve comparisons of the same "market basket" of goods in two geographic areas. The difference in the prices of the same market basket of goods is designed to reveal the differences in the geographic cost of living.

Retirees often search for areas of the country where it is not costly to live, and use the prices of the same market basket. The dilemma is that the average market basket may not represent the choices of a person in a particular geographic area. A retiree who relocates near the seashore, for example, may be more typical if he or she purchases a boat. However, "boat purchases" may not be included in the market basket but certainly are part of the cost of living in that geographic area. For the Consumer Price Index (CPI), created by the U.S. Bureau of Labor Statistics (BLS), a market basket is developed from expenditure information provided by families and individuals on what they actually bought. In 1993, 1994, and 1995, data were collected by BLS via a national sample of over 30,000 families who provided detailed information on their spending habits. This data enabled BLS to construct the CPI market basket of goods and services and to assign each item in the market basket a weight, or importance, based on total family expenditures. The final stage in the sampling process was the selection of the specific detailed item to be priced in each outlet, which was undertaken by BLS field staff. Examples of some of the more than 200 items included in the CPI market basket appear in table 1-1 (Williams 1996).

Of course, the reader can immediately detect two difficulties with this market basket. Where, for example, are personal computers, something many households are currently purchasing, but did not between 1982 and 1984? In addi-

Table 1-1. —Items included in the CPI market basket

Item category	Examples
Food and beverages	Cookies; cereals; cheese; coffee; chicken; beer and ale
Housing	Rent; homeowner's costs; fuel oil; housekeeping supplies; local phone service
Apparel	Men's shirts; women's dresses; jewelry
Transportation	Airline fares; new and used cars; gasoline; auto insurance
Medical care	Prescription drugs; eye care; physicians' services; hospital rooms
Entertainment	Newspapers; toys; musical instruments; admissions
Other goods and services	Haircuts; college tuition; bank fees

SOURCE: U.S. Department of Commerce, Bureau of Labor Statistics. December 1996. *Monthly Labor Review*, Appendix 1 "Item structure," 1987 and 1998.

tion, corporate downsizing may have caused families to change their spending behavior in 1995 and not engage in as many, or as expensive, apparel and entertainment purchases and restaurant meals between 1982 and 1984. Thus, the composition of the market basket changes over time, as does the relative weight of any component. Since January 1999, a geometric mean formula has been used to calculate most basic indexes within the CPI; in other words, the prices within most item categories (e.g., apples) are averaged using a geometric mean formula. This improvement moves the CPI somewhat closer to a cost-of-living measure, as the geometric mean formula allows for a modest amount of consumer substitution as relative prices within item categories change.

The most difficult problem in using a market basket is assessing differences in the quality of the items included in the market basket. For example, a 1984 automobile and a 1999 automobile have substantially different features, even for the same "base" price. How does one adjust the price of the 1984 automobile for air bags or anti-lock brake sys-

tems, which did not exist in 1984? BLS added an improvement to the CPI in 1987 to recognize quality adjustments of used car prices (Greenlees and Mason 1996).

Our quick exploration into geographic differences in the cost of living have also brought to mind other uses of price indexes. The CPI, when properly used, is a measure of the average change over time in the prices paid by urban consumers for a fixed market basket of consumer goods and services. In this sense, it is a "deflator." That is, 1999 purchases can be recast to reflect what they would have cost in 1984 dollars. It is *not* appropriate to use the CPI to compare geographic differences in the cost of living because the CPI measures only time-to-time changes in each place. A higher index for an area may simply mean that prices have risen faster since the 1982–84 base period. In addition, the CPI does not capture all living costs. Not only does the market basket not include new components that consumers are purchasing, but the CPI does not include changes in taxes.

When contemplating costs, people wish to:

(1) understand the difference in costs from one geographic area to another (cost of living);

(2) understand how costs have changed over time (inflation); and

(3) recognize changes in the quality and quantity of what is being purchased.

To discern these aspects of costs, most people desire an index in which to compare one location or time to another. The CPI uses an index, for example, 112, which is interpreted as meaning that a 12 percent increase in price has

taken place between the base time period [index = 100] and the year in which the index is reported as 112. An index of 80 would be interpreted as a 20 percent decrease in prices. Usually, the CPI base is recalculated every decade or so.

We have demonstrated with both houses and automobiles that measuring the cost from one geographic area to another, or the price of automobiles in one decade versus another, is problematic, as the quality and features are difficult to compare. We now turn to an even more difficult task: making these cost comparisons in education.

COST ADJUSTMENTS IN EDUCATION

Currently, per pupil expenditures or teacher salaries are commonly reported as nominal state or school district averages, without correction for differences in the geographic cost of living (U.S. Department of Education 1999). There is good empirical evidence that geographic cost differentials exist, however. For example, Barro (1994) states:

> *The fact that Florida spends 36 percent more than Arkansas to provide virtually the same staff-to-pupil ratio is largely explained by Florida's 28 percent higher instructional staff salaries (p. 7).*

Of course, as Barro notes, approximately 10 to 15 percent of the differences in average teacher salary is attributable to differences in average teacher experience and training. McMahon also notes differences in the cost of living between various counties in Illinois (McMahon 1996). As one might imagine, counties in the northern portion of the state, near Chicago, are more costly than those in the southern portion of the state.

Most of the cost of providing public education are personnel costs, such as providing employees' salaries and fringe benefits.[2] Salaries average about 65 percent of total current expenditures and employee benefits about another 16 percent, so that these two categories alone are responsible for over 80 percent of a school district's expenditures (Fowler 1993). Purchased professional services, which in part acquire the services of professionals,[3] account for more personnel expenditures, as does purchased property services[4] and student transportation. Supplies are truly minor in such an enterprise.

Although supplies represent less than 6 percent of all current expenditures for the average school district, the first work on cost indices was undertaken to understand the differences in the costs of supplies that school districts in differing geographic areas might encounter (Furno and Cuneo 1971). In one sense, the work was undertaken because the quality of school supplies differs minutely. The category "supplies" has a very specific meaning to accountants. They are materials that are consumed and have a life of less than 1 year, in contrast to equipment, which is more durable. Examples of supplies include photocopy paper, personal computer diskettes, and student workbooks. While some may wish to debate the attributes of one brand of personal computer diskettes over another, most persons will generally concede that they are interchangeable.

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[2] Benefits may include retirement, Social Security contributions, medical and group life insurance, unemployment, tuition reimbursement, workman's compensation, accrued sick leave, and professional dues and fees.

[3] Examples include architects, engineers, auditors, dentists, medical doctors, lawyers, consultants, computer programmers, psychologists, social workers, and accountants.

[4] Examples include utility and cleaning services, snow plowing, custodial services, lawn care, and repair and maintenance.

The personnel that staff school districts, however, are certainly not interchangeable, and have vastly different attributes, even if one compares them on such uniform characteristics as educational attainment and occupational experience. These differences make comparing geographic differences in the price of personnel difficult, as one might mistakenly measure differences in the jobs they perform or in their personal characteristics, such as the nature of the undergraduate institution they attended. Imagine, for a moment, that one school district is located in a suburban college town, while another is located in a rural area. Both spend the same per pupil, but the school district with the college offers post retirement positions to college faculty to teach secondary courses and to work in administrative and support services. Assuming such retired staff are still capable, the staff are of vastly different quality, despite comparable degree status, teaching experience, and expenditures.

It is these quality differences in education that make geographic cost differences so difficult to measure. School districts can choose to employ better educated, more experienced staff, or to reduce class size, or to hire more specialized staff, all of which are more expensive staff choices. They may wish to maintain small school systems, which may be more expensive to operate, or they may choose to hire expensive administrators. In short, while school districts must adhere to numerous rules and regulations from federal as well as state sources, they retain a significant amount of discretion over spending, particularly spending that goes beyond what mandates require.

Of course, if we could hold these discretionary choices of school districts constant from place to place, then measuring the costs school districts encounter that account for higher spending becomes easier. Certainly there are differences in the geographic cost of living, such as higher prices for land, which translates into higher salary and benefit

demands. Mediating such differences in the geographic cost of living are amenities associated with a given location. School district staff, like everyone else, would rather live near water (ocean, lake, or stream), where it does not snow (at least in Syracuse-size amounts), where crime is very rare, but with access to all urban amenities (shopping, arts, airports). Just as school districts choose to trade cost and class size, people trade salary and benefits for amenities. As Chambers and Fowler put it,

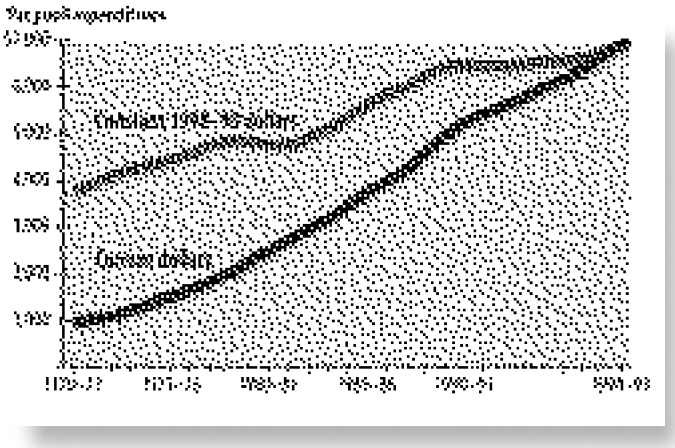
> *The intuitive notion underlying [the hedonic wage model] is that individuals care both about the quality of their work environment as well as the monetary rewards associated with particular employment alternatives, and that they will seek to attain the greatest possible personal satisfaction by selecting a job with the appropriate combination of monetary and nonmonetary rewards. (Chambers and Fowler 1995, xv).*

A cost-of-education index, therefore, must simultaneously take into account those discretionary factors that a school district might manipulate, such as quality and quantity of staff, and those nondiscretionary factors that the school district cannot control, such as the cost of living, the competitiveness of the labor market, and amenities, such as climate, absence of crime, and geographic location (such as proximity to water). The resulting index might be used to determine the cost to school districts, in different geographic locations, to acquire and retain similar qualities and quantities of staff. However, such an index does not describe what the CPI does, that is, it does not measure the change over time in the prices paid by school districts.

EDUCATION EXPENDITURES OVER TIME

Per pupil expenditures from 1970 to the present are sometimes reported in both current and "constant" dollars (see figure 1-1). Inflation has been removed from these expendi-

Figure 1-1.—Current per pupil expenditure in average daily attendance in public elementary and secondary schools: 1998–99



SOURCE: U.S. Department of Education, National Center for Education Statistics, *Statistics of State School Systems, Revenues and Expenditures for Public Elementary and Secondary Education*; and Common Core of Data surveys, unpublished tabulations.

tures by using the CPI. Thus, the reported 1970–71 per pupil expenditure of $3,774 is reported in constant 1998–99 dollars as $6,915. Unfortunately, the CPI is not specifically designed to measure changes in education costs between time periods, that is, the market basket does not include public education costs (or taxes) (although it does include private school tuition). In addition, some argue that the CPI consistently overestimates inflation, which will make the 1970–71 per pupil expenditure higher than it should be; it makes us think that the investment in education has been greater than, in fact, it was (U.S. Senate 1996 [better known as the Boskin Commission]).

What would be ideal when wishing to report education expenditures over time would be a cost-of-education index that was computed each year (or every several years), that both held constant the average school district discretionary costs, while measuring those costs that a school district can-

not influence, including geographic amenities. Such an "education inflation index" would more accurately portray increases in education spending.

In this overview, we have tried to convey some flavor of the complexity of what most people intuitively know: there are differences in costs in differing geographic locations and in measuring inflation. These differences are difficult enough to measure in price indices, given item substitution and changes in item quality. However, measuring cost differences in education is even more difficult, since most of the costs are in personnel, rather than in supplies. In the chapters that follow, we will endeavor to explain the differences between educational costs and expenditures; followed by two chapters that deal, in turn, with differences in the "unit price" of teachers and differences over time in the level of inflation. Chapter 5 examines existing indices that can be used to make adjustments for these differences in cost, and Chapter 6 reminds us all of what remains to be done.

Chapter 2. Making Sense of Differences in Education Costs

INTRODUCTION

"Cost" is a commonly used and widely misunderstood term. It lies at the center of many policy debates and is featured prominently in headlines that capture public attention. Debates over the cost of education are particularly common. Education is a costly activity, the resources flowing into the educational sector of the economy are large by any measure. For example, the National Center for Education Statistics (NCES) estimates that in 1995–96, the United States spent $287.7 billion on its public elementary and secondary schools.[5] The general public often thinks of "cost" in a comparative manner that implies excess, for example, "special education classes are very costly." Indeed, several researchers have ar-

[5] This figure excludes the resources devoted to all higher education and nonformal education, not to mention private elementary and secondary education (U.S. Department of Education 1998).

gued that additional funds in the last quarter-century have gone toward special education, rather than regular education programs (Rothstein and Miles 1995; Lankford and Wyckoff 1996).

It is true that many contemporary reform efforts in education are associated with significant costs. California has initiated a program that is designed to hire additional teachers, in an effort to lower class sizes statewide. In May 1997, the New Jersey Supreme Court ordered the state to provide $246 million to 28 urban school districts for "regular" education in 1997–98 to bring their per pupil spending levels to comparable levels of the wealthiest school districts in the state.

Unfortunately, this widespread interest in cost is not paralleled by a comprehensive understanding of what costs are and why they can vary both geographically and over time.

It is important for those concerned with education policy to have a good working understanding of the concept of cost, and the purpose of this chapter is to provide an introduction to the issues that are involved. While a comprehensive treatment of cost can easily fill multiple volumes, we place our emphasis here on preparing the reader to better understand what gives rise to costs and why they can vary across regions as well as over time.

The Difference Between Cost and Expenditure

It is useful to maintain a sharp distinction between the idea of a cost and an expenditure as we think about why costs vary and what policymakers might do in response. We shall use the term "cost" to characterize what must be given up in order to accomplish some result. "Cost" in this context

also implies expending the minimum expenditure needed to obtain the item or service purchased. Economists place considerable emphasis on this idea of sacrifice or foregone opportunity when they speak of "costs." When a resource is utilized in one way, the idea is that there are any number of alternative uses that are being missed. The best of these constitutes the "opportunity cost" of using the resource in a particular way. Under certain circumstances, market prices provide accurate indications of opportunity costs. However, if the markets are not competitive or if there are restrictions on the ability to trade resources in markets, then observed market prices may misrepresent the real opportunity cost of a particular resource.

On its face, this conception of cost seems straightforward, but there are several complexities that need to be kept in mind. First, cost is measured by the "best" opportunity foregone and there remains ambiguity about what counts as "best." For example, what is the "best" use of a young child's time? How might we compare the relative merits of time spent learning to read with time spent playing with peers? Second, notice that there is no explicit reference to monetary units. This idea of cost is relatively abstract and may or may not lend itself to a dollar and cents metric. Continuing with the example of a young child's time, the use that is easiest to associate with a dollar metric (i.e., time spent being employed in a labor market) could suggest that the time has a low value in contrast to a better use that is less easily measured in immediate monetary terms (i.e., time spent learning to read).

Third, notice that this treatment of cost requires insight into what the resource could be used to accomplish. Resources are not valuable for their own sake. They acquire value because they are instrumental in realizing desired results. It follows that the idea of cost cannot be divorced from benefits received.

"Expenditure," in contrast, is primarily an accounting concept and is intended to capture flows of resources, typically measured in monetary units. An expenditure need not be tied to outcomes or benefits. Dollars can move from one account to another with little consequence. Perhaps most importantly, expenditures can exceed costs, which can happen for a variety of reasons. For example, school districts vary enormously in the percentage of revenues they receive from federal and state sources. When the percentage of revenue coming from non-local sources is high, there is sometimes a worry that local decisionmakers will have less of an incentive to be diligent in their efforts to keep expenditures in line with actual costs. These cases can be thought of as instances where local decisionmakers are expending other taxpayers' resources, and worries of this sort give rise to various kinds of oversight and regulatory efforts. Although it is common to think of affluent school districts in this regard, in public elementary/secondary education there is some evidence that poor, heavily state-subsidized school districts spend less efficiently (Barrow and Rouse 2000).

Perhaps more common is that school programs operate almost independently and in ignorance of expenditures. Few principals or teachers know what the program they are involved in expends. Rather, such information is held by the school district business official. Principals and teachers often only become aware of the expenditures of their program when they are told by the school district business official that some reduction in the program must occur because of a lack of funds. This reduction seldom results in operating a program at a level of minimum expenditures. Programs operate at the level of funds available, and if greater funds are available than in a previous year, program expansion may occur, regardless of the theoretical "cost" of the program, that is, the minimum expenditure required to operate the program at a successful level.

Another reason for expenditures to exceed costs can be traced to differences in views over the level of outcome that is expected from the system. Disagreements can exist about what the minimum level of educational outcome should be. A local decision to set the level at a relatively high magnitude will involve an expenditure of resources beyond what it would cost to operate the system at a lower magnitude. States will sometimes stipulate a minimum level of offering along with a willingness to permit individual districts to exceed the minimum so long as local taxpayers cover the costs. This practice can lead to a great deal of inequality across districts, along with instances where districts are spending beyond what is required to provide the state-specified minimum offering. If the state-specified minimum is sufficiently low, the result can be instances where some districts provide attractive, modern, climate-controlled classrooms with many adults helping students learn, while other districts rely heavily on the individual teacher working with many needy students in unattractive, ancient, unrenovated classrooms that are unbearably hot or cold.

Notions of expenditure and cost can become mixed as in a case in which one hears that a preschool tutoring program costs more than a preschool program such as Head Start. A simple comparison of the resources expended on each program provides little direct insight into how the *costs* of these two activities compare. A valid cost comparison would require some ability to control for differences in the outcomes or benefits being realized. Only then can a comparison of expenditure data be interpreted as a comparison of costs, assuming, of course, that there has been a comprehensive accounting of all of the resources that are involved, and assuming that the identified resources all lend themselves to dollar and cents metrics. Similarly, the fact that one local education agency (LEA) spends two or three times more per pupil than another local education agency provides little

direct information about how education costs vary between the two. It is even possible for the costs to be lower in the higher spending place.[6]

We shall be concerned in this monograph with differences in cost rather than differences in expenditure. We are interested in the minimum resources required to generate a certain set of benefits or outcomes and how these vary cross-sectionally across geographic regions as well as over time. A problem we face is that while expenditure data are plentiful, bonafide cost data are difficult to obtain. Indeed, much of what we talk about in this monograph can be thought of as efforts to adjust available expenditure data so that they become reasonable to interpret in terms of underlying differences in cost.

Sources of Cost

In addition to maintaining a distinction between expenditures and costs, it is useful to conceive of a multilevel terrace or a resource allocation hierarchy that exists within education. At the bottom of the hierarchy are the individual ingredients or inputs (such as teachers) that comprise educational activities. At the next level, there are specific configurations of inputs (i.e., ways in which inputs are combined to provide educational services), each with different cost implications. At the top of the hierarchy are the long-term social and economic consequences or outcomes of education, through which we can truly arrive at a notion of the cost of a program. We shall discuss the individual levels of this hierarchy in turn, beginning at the bottom and working toward the top.

[6] For a more detailed treatment of differences between costs and expenditures, see Monk (1996). For a cost analysis of education reform that places emphasis on the use of donated resources that are difficult to measure in terms of dollars and cents, see King (1994).

Inputs to Education

Examples of educational inputs include things such as the time of a teacher, a supply of computer software or hardware, and the electricity needed to light a room or operate a computer. Of course, these "inputs" themselves are the outcomes of production processes located elsewhere within the economy. Computing software is developed by specialists, electricity is the output of a power plant, and teaching expertise arises out of a lengthy production process experienced by aspiring teachers. But for our purposes, it is sufficient to think of these inputs as the ingredients or building blocks of educational services.

An important type of cost arises at the ingredient level of the education production hierarchy. These are often referred to as "unit costs or unit prices," as in the unit cost of a teacher's time or the unit cost of electricity. The cost of an hour of a teacher's time, the cost of a box of pencils, and the cost of a kilowatt of electricity all constitute unit costs that contribute to the ultimate cost of education. It costs something (i.e., an alternative use must be given up) to acquire the use of a unit of all these educational inputs, and these unit costs constitute an important source of the bottom-line costs of education. Normally, these ingredient building blocks appear in a classroom.

Configurations of Education Inputs

It is one thing to think of the various purchased, hired, and donated resources or inputs that can be identified as the ingredients of education. The list can be quite lengthy and comprehensive. But, it is quite another matter to recognize that these inputs are configured thanks to a complex set of resource allocation practices to form what constitute educational services or opportunities for students. Any number of decisions are made that give rise to the things that have the modern trappings of "classrooms," "schools," and "school districts."

These decisions about the "configuration" of inputs have important implications for cost because they specify how much of each resource will be devoted to each educational service that is being provided. For example, a decision might be made to hire teachers at the rate of 1 full time equivalent (FTE) per 20 students in enrollment. This decision has implications for how many teachers the school in question will hire, and the number of teachers on the school's payroll has straightforward implications for the level of resources that is being invested in the school. Similarly, decisions need to be made about how much floor space to provide, how many computers to provide, how many teacher aides to hire, and how often to replace textbooks and software, to name just a few. All of these decisions have implications for the overall level of resources that are to be invested in the school.

Clearly, some configurations of inputs will be more resource intensive than others. A school that provides extensive amounts of small group and tutorial instructional settings with teachers will find itself making use of greater quantities of teacher resources than will a school that is structured around whole class and large lecture types of learning opportunities.

The important point to keep in mind is that decisions about how to configure the resources give rise to costs that are conceptually distinct from the unit costs that were introduced earlier. A decision to provide smaller classes will require more resources even if the hourly wages of the teachers involved remain unchanged. While these sources of cost may be conceptually distinct, it is worth noting that they may be connected. For example, in the face of limited budgets, high teacher wages can lead to larger class sizes. Moreover, a decision to reduce class size on a large scale will generate additional demand for teachers, which, in turn, can bid up the cost of teacher salaries.

It is useful to consider the role of central administrative services in the context of this middle level of the resource allocation hierarchy that we are exploring. If schools and classrooms are where individual ingredients are configured to provide educational services, the school district is the place where the configurations are organized to operate. Business functions such as budgeting, payroll, purchasing, warehousing, printing, and auditing reside here. Staff services, such as recruiting and hiring, in-service training, and health services also predominate here. Student transportation and food service are frequently organized at this level, as are planning, research and evaluation units, and management information systems. Large school districts might also have school facilities repair, renovation, and even construction at this level. These costs might be more appropriately examined neither on a unit basis, nor on a service configuration basis, but rather as a proportion of all the resources a school district has to employ. Thus, the ratio of administrative expenditures to instructional expenditures becomes a metric of costs that is neither a "unit cost," such as the hourly wage of a teacher, nor a "delivery configuration cost," such as smaller classes, even with similar unit costs. Rather, it is again conceptually distinct, examining what a school district chooses to forgo by making certain other choices. School districts with exceptionally high ratios of administrative spending to instructional spending demonstrate a choice about how resources are allocated within the school system. While Dougherty (1996) found that small, wealthy school districts with high percentages of limited-English-proficient (LEP) students had higher administrative–instructional expenditure ratios, his site visits gave him insight into choices that these school districts had made. In one case, the district had one of the highest ratios of nonteachers to total staff, because the school district moved ineffective principals to the central office. In another district, three superintendents were receiving compen-

sation: two from previous contracts in which they had been dismissed prior to the termination of the contract; one of the former superintendents also was creating high legal costs for the school district, by suing it for wrongful termination. The resulting expenditures can be viewed as transactions costs, although to qualify as a transactions cost it would have to be the case that the dispute was unavoidable. If the district carelessly handled the dismissal and unnecessarily embroiled itself in litigation, the resulting legal expenses are quite real but strictly speaking do not count as costs.

Outcomes of Education

In our conceptualization of the production of education services at the school, we deliberately omitted reference to the supply of student time. We prefer to think of an educational service as a distinct configuration of purchased, hired, and donated resources where there is an intention to foster growth in student learning. However, we recognize that this growth can occur only if and to the extent that student time and effort are combined with the resources being made available by the school and perhaps others. Indeed, we recognize that students themselves have considerable discretion over their supply of time and effort to educational pursuits and that these decisions in part depend on the nature of the services or opportunities that they encounter.

For our purposes, it is sufficient to recognize that students can vary dramatically in their needs and ability to benefit from alternative configurations of resources, and that explicit decisions are made about which type of service to provide to which type of student over the course of time. These decisions have significant implications for cost given the large variation that can exist in the resource requirements of the various kinds of services that schools make available.

Thus, we view the mix and level of educational outcomes arising from schools as the byproduct of what happens when the highly varied nature of student time is added to the educational process. A school that finds itself populated by students with a high incidence of special needs will feel pressure to provide services that respond to these needs. We presume that greater needs translate into demands and expectations for more resource intensive configurations of schooling resources, and it follows that the presence of special needs within a school's clientele will contribute to the cost of producing a given level and distribution of learning outcomes.

This upward pressure on cost comes from the school's efforts to provide an appropriate mix of services (some more costly than others) to its clientele. Of course, limits on the availability of resources can severely restrict a school's ability to be responsive to these needs. What we can observe is the net result of a confrontation between need for appropriate services and the availability of resources. This was reflected in Dougherty's (1996) findings that small school districts in Texas that had high percentages of LEP students also had high administrative/instruction ratios. Parrish, Matsumoto, and Fowler (1995) found that school districts serving relatively higher percentages of students who are in poverty, and who are minority, spent a greater percentage of funds available to them for core instructional purposes. These districts also allocate a lower percentage of funds for administration and capital outlay. As minority enrollment and poverty increases, so does the student/teacher ratio.

To sum up: Decisions are made about the *mix* of services that are provided to students as well as about the *means* employed to provide each service. Decisions about the mix of services are driven in part by the incidence of special needs in the population of students being served by a school. De-

cisions are also made about the means (e.g., level of teacher qualification, class size, supply of paraprofessional support, etc.) and are driven by the technical properties of the services being delivered as well as by demand and supply considerations. Finally, decisions are made about how much to pay for each of the inputs that comprise the various services that are being provided. Each of these decisions has a bearing on the cost of producing educational results. The decisions may be inter-connected, but they arise out of conceptually distinct points in the production process, and it is useful to keep them distinct.

It is possible to look at state-by-state comparisons of expenditure data and work backwards to gain some first approximation estimates of the relative size of the various components of cost. Barro (1994) conducted this kind of analysis, and we provide an updated version in table 2-1.

Table 2-1. —Selected attributes of public elementary and secondary school districts, by state: School year 1994–95

State	Current per pupil expenditure (ADA)	Average annual teacher salary	Pupil/ teacher ratio	Indices: Current per pupil expenditure	Indices: Average annual teacher salary	Indices: Pupil/ teacher ratio
Connecticut	8,817	52,873	14.4	1.47	1.37	0.83
District of Columbia	9,335	46,170	13.2	1.56	1.19	0.76
Hawaii	6,078	40,695	17.9	1.02	1.05	1.04
Michigan	6,994	44,263	20.1	1.17	1.14	1.16
New Jersey	9,774	48,692	13.8	1.63	1.30	0.80
New York	9,623	50,303	15.2	1.61	1.30	0.88
Oregon	6,436	40,734	19.9	1.08	1.05	1.15
South Dakota	4,775	27,463	14.4	0.80	0.71	0.83
Utah	3,656	30,726	24.3	0.61	0.79	1.41
United States	5,988	38,678	17.3	1.00	1.00	1.00

SOURCE: U.S. Department of Education, National Center for Education Statistics. *Digest of Education Statistics 1997* (NCES 98–015).

The first three columns of table 2-1 provide breakdowns of the current per pupil expenditure, average teacher salaries, and the pupil/teacher ratio for 1994–95 for selected states. The next three columns of the table express this same information in the form of ratios to the relevant national average. These data provide a sense of how a state compares with the average for the Nation as a whole. For example, New York spent $9,623 per pupil in 1994–95 which placed it at 161 percent of the national average. New York's average teacher salary for that year was $50,303 which placed it at 130 percent of the national average. Finally, the pupil/teacher ratio in New York was 15.2 which was 88 percent of the national average.

From these data for New York, we gain some insight into the sources of the relatively high spending levels for school districts in the state. We see a state in which salary differences are above average for the Nation as a whole but not to the same degree as the district's overall spending levels. It is the relatively small class sizes in New York that boost spending levels above what can be expected from salary levels alone.

Note that the salary differences correspond to unit price differences of an important input, while average class size data correspond to costs that arise from the second level of the resource allocation hierarchy where inputs are combined in particular ways. Table 2-1 does not provide direct insight into the incidence of special-need student populations, although this can certainly be part of what lies behind the variation that can be observed in average class size across the states shown in the table.

If we compare per pupil expenditure data across states, we find that there is quite a lot of variation (Utah is the lowest at $3,656, per pupil and New Jersey is the highest at $9,774 per pupil, a 3 to 1 difference). Table 2-1 provides compari-

sons across the states in some key data elements that help to illustrate the different sources of cost. For example, the data shown in the table makes it clear that there is much more interstate variation in per pupil spending than in the amount of teacher resources being supplied by each state. The easiest way to see this is to look at the range of the index numbers of per pupil expenditure and the pupil/teacher ratio. The index numbers for current per pupil expenditures range from 1.63 (New Jersey) to 0.611 (Utah) or 2.67 to 1. The index numbers for average teacher salaries range from 1.37 (Connecticut) to 0.710 (South Dakota) or 1.93 to 1. The index numbers for pupil/teacher ratios range from 1.41 (Utah) to 0.76 (District of Columbia) or 1.84 to 1.

It is very clear that differences in per pupil spending are related to differences in pupil/teacher ratios but that much more is occurring. In fact, there are some instances where states with high per pupil spending actually have relatively high pupil/teacher ratios. For example, Hawaii is over 1.0 for both per pupil spending and pupil/teacher ratios; this is also true in Michigan. The high levels of teacher salaries in both Hawaii and Michigan help to explain the high spending levels despite the relatively large class sizes, but this need not be the case as data for Oregon demonstrate. It is clear that costs and the associated levels of spending arise at many different points within the education production process.

Table 2-1 attempts to illustrate some first approximation estimates of the relative size of the various components of cost. To reiterate, there are theoretically different costs that arise within each terrace or level of the resource allocation hierarchy. At the classroom level, we might refer to the unit cost of educating a student with special needs of some kind. We note that because teachers of special needs students require unique skills, it may be necessary to pay them a salary premium. These premiums will exert upward pressure on costs, and one reaction of the system could be an

effort to economize by increasing class size. In addition, we find that school districts with high concentrations of special needs students have high administrative instruction expenditure ratios, implying that they are making choices among alternatives in distributing resources.

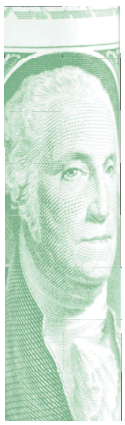
It is clear that costs and the associated levels of spending arise at many different points within education production process.

Implications of Variation in Cost for the Public Financing of Education

Existing Adjustments for Differences in Cost

Now that we have introduced the idea of "cost," and have begun to explore the various ways that costs are generated, it is clear that variation is likely to exist across schooling units. Different schools may face different unit costs for the ingredients they seek to provide; they may find themselves combining the inputs in different ways; and they may face dramatically different types of students with differing educational needs. Moreover, whatever the variation is at one point in time it is not likely to remain constant. Conditions can and surely will change, and the cross-sectional differences that exist today may be quite different from the cross-sectional differences that existed yesterday or will exist tomorrow.

If education were an entirely private matter, these cross-sectional as well as longitudinal differences of cost would not be a major source of concern for policymakers. However, education plays a significant public role, and public revenues from one or another unit of government are present within most schools, particularly at the elementary and secondary levels. As we have seen, in 1995–96, elementary and secondary education revenues were estimated by the



NCES to be in excess of $287 billion dollars, of which approximately half come from local revenue, about 45 percent from state revenue, and the remainder from federal revenue.

The presence of these public resources within the schools prompts important policy questions about how best to make distributions of these public revenues. Disparities in resources between property-wealthy and property-poor school districts has been a continuing problem in American elementary and secondary education. State aid to local school districts often is driven primarily by considerations of creating resource equality for property-poor school districts. Property-poor school districts are also often populated by students with exceptional educational needs, including residing in poverty, LEP status, and disabling condition. Paradoxically, many urban school districts with limited local revenues and large numbers of students in poverty are located in metropolitan centers with high costs of living.

One of the purposes of providing public revenues for education is to offset differences in the costs being faced by schooling units, and attempts have been made over the years to provide adjustments for all three of the sources of cost variation that we identified in the previous section (input costs, configuration costs, and output costs). For example, efforts have been made in different states to take account of cost differences associated with the presence of students with special learning needs. It is common, for example, to build weights into aid formulas that provide public aid to local education agencies with high proportions of students with special educational needs. These special needs include attributes like limited-English speaking ability, the presence of economic disadvantage, and the presence of disabilities, to name just a few. Both the federal and state governments make use of student weights to send aid to places that are

perceived to face higher costs due to the presence of special populations of students.

A small number of states provide explicit adjustments for differences in the input costs of the ingredients of schooling. The rationale for these input cost adjustments is straightforward: if a given ingredient costs more in some places than in others, an adjustment needs to be made in the distribution of dollar amounts to reflect the underlying differences in cost. Interest seems to be growing in these unit cost adjustments, and a literature is developing to begin to provide estimates of the magnitudes that exist (Chambers 1978, 1981, 1997, 1998; Chambers and Fowler 1995; Duncombe, Ruggiero, and Yinger 1996; Guthrie and Rothstein 1999; McMahon 1996; McMahon and Chang 1991; Monk and Rice 1999; Monk and Walker 1991; Reschovsky and Imazeki 1998).

In addition, a number of states provide special allocations to local education agencies based on considerations of how resources are combined to form educational services (configuration costs). Perhaps the most common adjustment of this type involves paying additional aid to school districts that face diseconomies of small scale. In these cases, aid is paid to offset the costs of operating unusually small classes due to low counts of pupils.

Finally, Texas is an example of a state that examines the relative efficiency of school district operations, by examining the ratio of administrative expenditures/instructional expenditures. The state has implemented a program for flagging those school districts whose administrative expenditures/instructional expenditures are outliers, which, if not remedied within a few years, would lead the state to recover the excess (Lewis 1996).

We close this chapter with observations about two common problems that surround efforts to use public revenues to compensate or offset differences in the cost of education.

Risks of Over/Under Adjustment for Differences in Cost

We note above that there is ample precedent for units of government at both the state and federal levels to make adjustments in the distribution of school aid for differences in the costs of education. We also have noted that there is precedent for cost adjustments that are targeted on each of the three levels of the production hierarchy. However, the mere fact that an adjustment is made does not mean that the magnitude of the adjustment was correct. For example, there is an on-going and very lively debate over the correct magnitude of the weight to use to adjust for the costs of educating students with special educational needs. Currently there are proposals to move away from a weighting approach, in part, because it is so difficult to derive uncontroversial weights (Parrish 1996). Similarly, there is controversy over the best way to adjust for differences in costs that stem from scale diseconomies, that is, in the size of schools and school districts, and there is a great deal of disagreement about the best way to adjust for differences in the unit costs of individual ingredients, such as teachers' salaries.

The difficulties associated with developing clean and noncontroversial estimates of cost differences are intensified by the fact that a given feature in a school aid formula (be it state or federal) can function to adjust for multiple sources of cost. For example, suppose it is the case that the unit costs of important schooling ingredients are high in places that also enroll high percentages of pupils with special educational needs. More concretely, suppose it is the case that teachers' salaries in urban school districts require a "battle-

pay" premium, and it is in precisely those urban school districts that children do not learn unless a variety of special programs are implemented.

A policy-making body might reason that urban districts tend to be located in areas with high incidence of students with special needs and that urban districts also tend to be located in places where the costs of key inputs (like teachers' time) are high. Such a policy-making body might conclude that it is therefore prudent to provide relatively large adjustments for urban settings per se or for the presence of students with special needs on the grounds that costs of inputs also tend to be high. The result could be a set of weights or other adjustments that implicitly introduce beliefs about differences in the costs of inputs without doing so explicitly in the formula.

The potential for "overlap" of this kind needs to be kept in mind. It is not wise to focus on one portion of an aid system as if it exists in isolation from all remaining parts; however, components of an aid system that are disequalizing should be closely examined in light of the entire funding system. Ideally, a school aid system should be calibrated so that overlap is taken into account and aid offsets actual differences in cost.

Maintaining the Difference between Costs and Expenditures

A second recurring difficulty involves maintaining the distinction introduced earlier between costs and expenditures. It is possible to total expenditures on education, and it is possible to apportion them across the three major sources of cost difference that were identified earlier. What is more difficult is determining how much of the observed differences in resource allocation is attributable to differences in cost rather than *nominal differences in expenditure*. An

example from the economies of scale research literature (that is, the efficacy of schools and school districts of different sizes) provides good insight into this problem.

One of the questions that arises in the debate over whether or not to compensate local education agencies for diseconomies of small scale is whether the diseconomies are unavoidable. It could be the case that a given unit is small in size and finds itself offering unusually small classes because it refuses unreasonably to join with a neighboring school district. In such a case, why should the taxpayers of a state provide extra resources to a school district that could operate more efficiently as a merged unit?

Notice the use of the word "unreasonably" in the previous paragraph. Much turns on what counts as a "reasonable" refusal to reorganize into a larger unit, and herein lies the potential for considerable controversy. From a cost perspective, the element of discretion needs to be removed. Pure cost differences arise when there is no choice but to operate the smaller classes. Moreover, attention needs to be paid to differences that might occur on the outcome side.[7]

A second example arises in the case of adjustments for differences in the incidence of students with special needs. Some districts may recognize more of these than others. A common standard needs to be imposed before the differences can be safely interpreted as differences in costs.

A final example concerns adjustments for differences in the unit costs of individual inputs. The fact that one district pays higher teacher salaries than another does not necessar-

[7] Student outcomes in very small classes may be quite different from what arises out of larger instructional settings. Recall that cost analyses require controls on the benefits being realized. True economies of scale exist when the unit cost of producing the *identical* outcomes drops as size increases. See Lee and Smith (1997).

ily mean that the resulting differences in expenditures constitute differences in actual costs. A district may choose to spend more than is necessary to hire teachers with given characteristics. Such a willingness to spend at higher levels should not be confused with the idea that it costs this district more to provide education.

Much of what follows addresses efforts that have been made to disentangle costs from expenditures. We begin in Chapter 3 with cross-sectional differences in the unit price of an important educational ingredient—namely, the time of teachers. Chapter 4 focuses attention on adjustments for changes in costs over time.

Chapter 3. Geographically Based Cost Adjustments

Chapter 2 dealt broadly with the notion of cost and its application to policy debates in education. Given the broadness of the cost construct, it makes good sense to narrow our focus, and we do so by concentrating on a particular component of cost—namely, the unit price of inputs. In fact, we go further and focus most of our attention on the unit price of *teacher* inputs. Our reasons are several: First, teachers constitute an important ingredient in education and represent a significant source of education's full cost.[8] Second, there appears to be a substantial amount of variation in these costs. Schneider and Nelson (1998) report that 1996–97 average teacher salaries among the states varied widely with Connecticut showing the highest average salaries ($51,181) and

[8] Barro (1994) reports evidence showing that teacher compensation accounts for 51.9 percent and also argues that the professional staff component of schools represents roughly two-thirds of the budget package.

South Dakota showing the lowest ($27,072) (a difference of about 1.9 to 1). Third, existing attempts to isolate the real cost component of these nominal differences in spending have resulted in a complex literature that is difficult to interpret. There are several different indices available currently and quite a bit of uncertainty about which one is best to use for which purpose. One of our most important goals in this monograph is to provide guidance to policymakers who are trying to make sense of the existing progress in the analysis of costs, and it thus makes good sense for us to focus attention on this particular branch of cost analysis.

The key question that will occupy us throughout this chapter involves the nature of geographic variation in these unit prices for teachers. To be more specific, we will be trying to understand why it may cost more in one place than another to hire (and retain) a given teacher for a given job. The chapter begins with a discussion of the mechanics associated with estimating geographically based differences in teacher's salaries. Here we establish the principles that need to be adhered to in the construction of adjustment indices that purport to capture these geographic differences in cost.

We turn next to an overview of the major existing studies where scholars have made progress toward constructing these cost indices. The chapter concludes with further discussion about issues that remain unresolved.

The Construction of a Geographically Based Teacher Price Index

Purpose of the Index

The purpose of a geographically based teacher price index is disarmingly simple. All the analyst wants to do is find

out how much more it costs one place relative to another place to engage the services of comparable teachers. But, there are two implicit kinds of knowledge this formulation presupposes that cause many difficulties. First, there is the realization that teachers vary in any number of ways that can have bearing on their effectiveness. Thus, it is not so clear who these teachers are whose services are to be engaged.[9] Second, there is the distinction drawn in Chapter 2 between costs and expenditures. Just because an local education agency or a state (on average) pays a certain amount to hire certain kinds of teachers says very little about whether or not all of these resources were *required* to hire and retain these teachers. For example, well qualified, certified, experienced, and degreed special education teachers might choose to teach in Princeton school district even if the school district offered a lower salary than neighboring or comparably-situated school districts. When Princeton school district also offers superb salaries and benefits, lower-than-mandated class sizes, adult classroom assistance (aides), plentiful support staff (such as psychologists, and social workers), as well as top-of-the line facilities, one can begin to understand that perhaps all these rich resources were not *required* to attract and retain the special education staff. As we shall see, analysts have responded in various ways to these challenges, but the first step is to be clear about what costs are relevant and what influences on cost need to be considered. We can take this step by beginning to develop an underlying cost model.

Specification of the Underlying Cost Model

It is useful to have a good understanding of what can influence the cost of hiring and retaining teachers, and this is what a cost model attempts to provide. In the following

[9] Moreover, the meaning of "engaged" needs clarification. It is one thing to hire teachers and may be quite another to retain their services over some period of time.

discussion we make points about the types of cost that are typically considered in addition to the many different possible influences on costs.

Selection of Outcomes

The cost outcome of interest typically is a salary figure for teachers. Strictly speaking, analysts are interested in the dollar value of the entire package of benefits provided to teachers, but information about health, pension, and other nonsalary benefits typically is not available in comparable forms. These omissions are unfortunate since they force the assumption that nonsalary benefits vary in direct proportion to observed differences in salaries, and this may or may not be the case.

Selection of Influences

There are many different possible influences on teacher compensation. These are listed below and are organized under a series of broad headings. As we shall see at the end of the chapter, analysts vary in how they handle the various possible influences. Some place emphasis on one category of influence to the exclusion of others, while others are more ambitious in the sense that they deal explicitly with a more inclusive list. What we provide is a list of the various possible influences on salaries as well as some comment on the difficulties that can surround efforts to measure the precise magnitude of the influence. Recall that the goal is to identify the cost of hiring "comparable teachers" in comparable job assignments. A number of different teacher characteristics can be entered into a cost model as part of an attempt to control for differences in the types of teachers being hired across jurisdictions, be they states or individual school districts.

Teacher characteristics. The standard teacher characteristic variables include level of experience (usually years in teaching) and training (usually highest university degree

attained). The goal is to control for these differences so that the resulting cost comparisons capture differences in what is spent to hire teachers with the same experience and training credentials. The extent to which experience and degree status explains compensation, however, often varies between states, and rarely explains more than one-third of the observed variation. Analysts have also broadened this list to include attributes like the incidence of female teachers, the incidence of minority teachers, and other attributes that are believed to affect teacher salaries and benefits, such as the undergraduate university attended.

Cost of living. There are good reasons to believe that the basic costs of living vary geographically. Indeed, the federal government published statistics that measure changes over time in consumer prices by region of the country (the best known of these is the Consumer Price Index (CPI)). These differences in costs of living are believed to affect teacher labor markets such that when all else is equal, the higher the cost of living, the higher will be the salary that needs to be paid to hire a teacher with a given set of credentials. Therefore, it is common to find one or more cost-of-living variables included in a cost of education index calculation.

Regional amenities. It is also widely recognized that regions vary in their level of attractiveness. Some places have pleasant mixes of cultural activities and aesthetically appealing features such as close proximity to water and other places for recreation. Places also vary in the level of safety they offer, and perceptions of safety can constitute an important amenity in people's minds. Some regions have adverse climatic conditions, such as excessive snow.

When positive amenities are significant, the expectation is that school districts, all else equal, will be able to offer lower salaries and benefits to teachers and still have a comparable

pool of applicants. Thus, measures of attractive regional amenities are expected to have negative effects on teacher salaries. The idea is that part of the compensation being received by teachers in an attractive region is the opportunity to be in close proximity to amenities and that districts are able to take advantage of this by offering lower monetary salaries than would otherwise need to be the case.

Employment amenities. In contrast to the amenities that might be associated with a region, there are day-to-day features of the job itself that can have influence on the willingness of teachers to accept employment at a particular salary. While all jobs have their frustrations, it stands to reason that some will be more engaging and satisfying than others, and the expectation is that, all else equal, teachers will accept employment for lower salaries when the job is perceived to be relatively pleasant. The same argument suggests that if the job is perceived to be relatively difficult, a premium will need to be offered in order to attract a comparable pool of teacher applicants.

Analysts have used various indicators of job amenities. For example, attempts have been made to depict workload in terms of the length of the school year, average class size, and number of nonteaching duties. Attempts also have been made to capture elements of day-to-day working conditions by measuring the incidence of disciplinary problems, the quality of school leadership, and the emphasis placed on teaching and learning.

It is important to distinguish clearly between regional amenities, over which schools have little or no influence, and amenities that stem from working conditions, over which school officials presumably exercise some discretion. Recall that it is important to distinguish between things within and outside of the control of school officials. A problem arises when a feature does not fall sharply on one side or

the other of this divide. Consider, for example, the incidence of disciplinary problems within a school. One might argue that this is outside of the direct control of school officials; on the other hand, steps could be taken within schools that have direct effects on the frequency of upsetting incidents for teachers. As we shall see, it is not obvious how best to handle features like the incidence of disciplinary problems.

Nonteaching wages and employment opportunities in the region. The concern here is with the degree of competition in regional labor markets for individuals with the kind of skills typically embodied in teachers. When this competition is intense, it is thought that teachers' salaries will tend to be higher, all else equal. School districts which must compete with other employers to hire college-educated labor will have to match the offers that are being made, driving salaries upward.

Unions and collective bargaining. Labor economists have devoted considerable effort to studying the impact of teacher unionization on teacher salaries. The conventional view is that unionization, all else equal, has a positive impact on salaries, and it would seem to follow that measures of the presence and degree of effectiveness of teacher unions would have positive impacts on wages and benefits for teachers. However, there can be countervailing influences such as situations where competition is limited due to the presence of a single large school district as is the case in many southern areas of the country where districts are organized at the county level. Moreover, states may enact labor legislation that favors or disadvantages the ability of teachers to unionize, and variation can exist within a given regulatory environment in the degree to which unions actually form and are effective.

Demand for teacher quality. The price of teaching talent is the result of a complex interaction of supply and demand considerations. We want to want to know what it would cost to increase teacher "quality" by some amount, and this presupposes an ability to agree about how to conceptualize and measure teacher quality. Consensus about what constitutes teacher quality may be growing (see for example, Ferguson and Ladd 1996), but this remains a difficult and controversial area of research. The problem is compounded by the fact that the price for teacher quality, in turn, can influence the underlying demand a community has for teacher quality. It is difficult to isolate these two effects; they are inextricably intertwined, creating a serious statistical problem for cost analysts.

There has been a large research effort to examine the demand for teacher quality, and attention has been paid to the fiscal capacity of the unit in question (state or individual school district), demographic and socioeconomic status attributes, and various measures that are designed to capture the "taste" for education. The kinds of variables that have been examined in this context are measures of local property wealth and income expressed on a per pupil or per capita basis, community education levels, and measures of commitment to education, such as the level of spending on higher education.

An added difficulty is that a number of these demand attributes can affect the cost of teachers in a number of different ways. For example, levels of education in the community can affect the demand for education which, all else equal, can be expected to be positively related to the supply price of teachers. As communities demand more education, they will bid up the prices of inputs, including teacher inputs. However, levels of education attained by community members may also have direct effects on teachers' perceptions of job amenities. To the degree that the children

of well educated people enhance teachers' perceptions of job amenities, community education levels can be expected to have a negative effect on teacher salaries (the more pleasant the job, the lower the salary needs to be to attract a given pool of applicants). It is clear that a community's demand for education is a relevant consideration in the analysis of what influences teacher salaries and needs to be taken into account.

Previous Attempts to Estimate Geographically Based Cost Indices

Scholars who work in this area vary substantially in how they think about the best way to apply current knowledge about costs to the creation of indices that may be used in a wide variety of ways. Some are quite cautious and think that it is better to rely on less ambitious indices that are based on relatively simple models and dependable data. Others believe that the compelling nature of the need for cost-based adjustments justifies the use of more ambitious models, which require data and models that require sometimes debatable assumptions. This overview of previous work is organized into four major sections, each corresponding to an alternative approach.

Teacher Attribute Models

Stephen Barro made a major contribution to the cost index debate when he prepared a working paper for the NCES in 1994 (Barro 1994). This report provides a thorough conceptual examination of the problems associated with constructing estimates of geographic cost indices. Barro distinguished explicitly among different types of indices and assessed the advantages and disadvantages of each.

Barro is cautious in his approach. He takes the view that it is better to adopt a less ambitious index—less ambitious in

the sense that it takes explicit account of fewer elements of cost—that is based on dependable data than it is to rely on more complicated models that force numerous assumptions about how to interpret key pieces of data. In Barro's view, it is more defensible given the current state of this field to keep the focus on inter-state differences in cost. He also advises policymakers to keep their focus on relatively straightforward measures of teacher attributes—namely, experience and training levels. The inter-state nature of Barro's work makes it most directly applicable to problems the federal government faces as it seeks to develop funding and other polices that affect multiple states. He notes that existing federal cost adjustments for education programs are quite crude and suggests that considerable progress could be made by taking advantage of data that are now available.

In his data analyses, Barro uses the Schools and Staffing Survey (SASS) data that had just become available at the time of his report.[10] As he notes,

> *The possibility of adjusting an index of average teacher salary to reflect interstate differences in experience and training was precluded until recently by the absence of suitable data on these characteristics of teachers, but the SASS data base not only provides these variables but also supports statistical adjustment procedures based on thousands of individual-teacher observations (Barro 1994, 120).*

The cost index Barro developed is based on an estimate of what each state's average teacher salary would be if the state employed teachers with the same average experience and training as that found in the Nation as a whole (Barro 1994, 122).

[10] The Schools and Staffing Survey (SASS) data are collected by the NCES.

Barro makes the important point that all of the adjustments he considers deal only with the teacher input and admonishes readers to avoid using indices of this type to adjust total expenditures on education. He proceeds by developing a composite index that has three pieces: (a) an index for teacher and other professional labor costs that is based on an average teacher salary adjusted for experience and training; (b) a comprehensive index of private sector wages for other labor costs; and (c) a constant that represents the price of all other nonpersonnel resources. Barro's point is not that these nonpersonnel costs are uniform across the states, but rather that the relevant data are not available and it would be inappropriate to simply assume that nonpersonnel costs vary in the same way as do personnel costs. Thus, he eliminates variation from nonpersonnel inputs from his composite index. Finally, the three components of the index are weighted according to their respective shares of average educational expenditures, and the result is a single number for each state. Barro then provides a comparative analysis of how the composite index compares to other types of indices, including a comparison of average teacher salaries across the states.

As we indicated earlier, Barro is conservative in his approach to these adjustments. He prefers less ambitious indices that rely upon relatively few assumptions. He sees the advantages of developing more sophisticated supply and demand-based indices of teacher prices, particularly in the areas of controlling for inter-state differences in multiple characteristics of teachers and other staff, distinguishing between controllable and uncontrollable influences on salaries, and taking into account and differentiating between supply-side and demand-side influences on costs (Barro 1994, 158). However, he is unpersuaded that existing data and estimation methods are adequate to warrant moving in this direction. He is also very reluctant to take the analysis to the indi-

vidual district level, despite the fact that indices of this type are of great interest to state governments. Barro's policy recommendations follow directly from the posture he adopts. He places most of his emphasis on the importance of developing more sophisticated models and improved data sets. One senses that he is reluctant for the cost index estimates that are currently available (including his own) to be used in any sort of high stakes distribution of resources.

Market Basket Models

Efforts have also been made to develop education cost indices that are based on a "market-basket" approach. Professor Walter McMahon and his colleagues have written extensively on the application of market basket models to the construction of cost indices in education (McMahon 1996; McMahon and Chang 1991; and Nelson 1991). Their approach is different from Barro's in that they place emphasis on making adjustments that stem from differences in the cost of living from one region to another. In contrast to Barro, they do not focus on school personnel, and they are particularly wary of cost adjustments that attempt to adjust for elements such as the attractiveness of jobs provided by school districts on the grounds that these can easily create perverse incentives that will increase the cost of education if state policymakers include the cost adjustments in state school aid formulas. McMahon, in particular, reasons that it is best to base cost adjustments only on things that are clearly outside the control of school districts such as: wages that exist in other sectors of the economy and geographically based differences in the cost of living. He argues that elements such as the impact of climate on cost of living affects teachers as much as anyone else in the region and that the best strategy is to rely on those outside the education system to gain insight into differences in the affects of the cost of living on teachers and others who are involved in the schools. McMahon is skeptical of adjust-

ments that are based directly on the salaries of teachers or school administrators, even if there are assurances that only the uncontrollable effects on cost have been allowed to influence the resulting index. He is particularly concerned about the perverse incentives such adjustments can create that may increase costs and undermine the productivity of educational systems. For example, if the cost-adjusted state school aid formula awards school districts with higher teacher salaries with more state school aid, it may be because the teacher salaries were cost-adjusted to reflect higher costs-of living, or a school board and teachers' union which knows that the more they accelerate teacher compensation, the more they will be awarded.

McMahon acknowledges the drawbacks of not being able to adjust for the attractiveness of a teaching job as well as the fact that the quality of the labor pool can vary geographically. However, he thinks it is better to err on the side of caution and make sure that no perverse incentives are generated that can diminish cost-effectiveness.

McMahon also acknowledges that the danger of perverse effects stemming from the use of the more ambitious models are reduced if the results are only used for analyses of cost differences, efficiency, and equity. But, he worries that the temptation to use an index intended for research and comparative purposes for adjustments to federal and state aids will prove irresistible, and thinks the more prudent path to follow involves an emphasis on market basket estimates that are far removed from the decision making behaviors of school officials.

McMahon (1996) provides an example of the type of index he prefers that is based on: (a) the value of housing, (b) the per capita income, (c) the percent change in population for the preceding decade, and for some models (d) variables representing regions of the country. His goal is to estimate

the cost of living for a middle-income family of four that is presumed to be representative of teachers' or school administrators' families. His analyses are based on Bureau of Labor Statistics (BLS) data and later on data assembled by the American Chamber of Commerce Research Association (ACCRA). His 1996 publication is based on national data that come from 293 sampled school districts. Once the model is estimated, it can be used to calculate predicted cost-of-living indices at several levels of aggregation. McMahon (1996) presents results both for individual counties within Illinois as well as for whole states, and F. Howard Nelson used the approach to generate state-level indices for the Nation as a whole (Nelson 1991).

Hedonic Models

Jay Chambers is perhaps most prominently associated with the application of hedonic wage models to the calculation of cost of education indices for public schooling systems. He began this work with a cost index study of Missouri (Chambers 1978) and has since published an extensive number of studies that deal with various aspects of the approach. His recent work has been based on national data collected by the NCES (Chambers 1998). BLS has recently incorporated the use of hedonic models to adjust television prices, personal computers, and camcorders and VCRs for changes in quality (Liegey and Shepler 1999).

These efforts to apply hedonic models are among the most ambitious attempts to account for all that can influence the cost of inputs that figure prominently in the production of educational outcomes. These attempts differ in important ways from the approaches advocated by Barro and McMahon. For example, they are based on models of individual teacher behavior rather than organizational units like school districts. Moreover, they explicitly introduce aspects of the employment situation faced by teachers on

the grounds that the overall attractiveness of a job has important implications for the wage that will need to be paid to hire and retain a teacher with a given set of qualifications. In this sense the models are "hedonic" meaning that they are sensitive to whatever it is that teachers find attractive or repelling about a given career opportunity in education. The Chambers' models presume that salaries will need to be higher in places that are judged by teachers to be unattractive, all else equal, if the district hopes to attract a given talent pool. As we saw earlier in this chapter, these higher salaries count as "costs," to the extent that the district has no control over the features that create the underlying features that are considered unattractive by prospective teachers.

Recall that Barro and McMahon both recognize the relevance of this argument, but are skeptical of the adequacy of available models and data to disentangle the various influences on teacher salaries. The worry is that districts could find themselves being rewarded for running programs that teachers find unattractive. In contrast, Chambers is more confident of his ability to control appropriately for the creation of the untoward incentives that concern the critics of this approach. Chambers takes the position that improvements in the quality of data and the sophistication of econometric modeling techniques have greatly reduced the dangers of adopting these more ambitious models. He sees a compelling need for cost models that take into account as many relevant factors as possible. Chambers is convinced that his results are superior to those available elsewhere, although he readily concedes the need for additional refinement and improved data collection.

Teacher Cost Index. In a recent application of this approach, Chambers and Fowler (1995) drew upon SASS data for the 1990–91 school year to develop what they named a Teacher

Cost Index (TCI). The SASS data provide teacher personal characteristics (race, sex, education, experience), teacher working conditions (class size), and teacher salary information for a national sample of public school teachers. These teacher characteristics, combined with other data sources addressing the amenities of a location, permit the TCI to be empirically developed from the hedonic wage model (Chambers 1981). The hedonic wage model uses ordinary least squares regression techniques in an attempt to isolate and hold constant influences on cost over which school officials have discretion, while allowing the index to vary according to both regional and district cost factors that are outside school officials' control.

Chambers and Fowler generated both regional and district level indices for geographically based differences in the costs of teachers. Both of these indices were used to calculate state-by-state measures of teacher costs. These results are presented in the report along with comparisons across different types of districts (e.g., region, rural versus urban, size, isolation, and incidence of poverty).

While Chambers and Fowler present results that are based on regional- as well as district-level teacher cost indices, the emphasis in the report is on the regional index, in part because the results are more easily interpreted and more precise. The district-level index is more ambitious in the sense that it includes more of the possible influences on salaries, but the complexity of the model increases and the adequacy of the available data becomes more questionable.

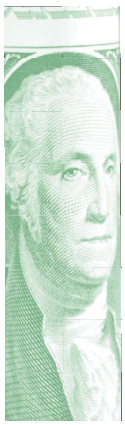
Cost of Education Index across geographic locations. Chambers (1998) more recently built upon the earlier TCI work by broadening the index to include other types of inputs (school administrators, noncertified school personnel, and nonpersonnel inputs). The new index, known as Cost of Education Index across geographic locations (GCEI), was

also calculated using SASS data for three points in time (1987–88, 1990–91, 1993–94), and also drew upon broader range of additional data sources, including the U.S. Bureau of Labor Statistics, the U.S. Geological Survey, the National Weather Service, the Uniform Crime Reports of the FBI, the City and County Databook, as well as from components of the consumer and producer price indices. The availability of multiple years of data permit calculations of changes over time in the cost of education, a subject we will return to in chapter 4.

The GCEI is a weighted composite index. In effect, Chambers builds on the TCI which focused solely on the cost of teacher inputs and adjusts it depending on his findings for the costs of administrators and other personnel as well as nonpersonnel items. As such, it is a more broadly representative index of costs than the earlier and more narrowly focused teacher cost index.

Production Function Models

The models we have reviewed to this point have all been concerned with the costs of important inputs into the educational process. Recall from Chapter 2 that these ingredient costs all exist at the first level of the multilevel hierarchy of costs that differentiated among the costs of inputs, services, and outcomes. Inputs must be combined to produce services which, in turn, are combined with students' time and effort to generate educational outcomes. As ambitious as the hedonic models are, it is possible to become even more ambitious by shifting the focus to the costs associated with actually realizing gains in educational performance. This approach explicitly requires the introduction of an *education production function* into the analysis. An education production function attempts to account for the transformation of inputs into gains in learning on the part of students.



The idea of a production function is borrowed from the study of manufacturing processes, and there is a lively debate among education scholars about how applicable the idea is to education. Production functions are directly linked to cost analyses since a production function, assuming its characteristics are known, reveals how much of each input is required under various conditions to produce a given gain in student performance. This information, along with information about both the unit prices of the inputs and the implications of constraints such as small or large scales of operation, would provide the information needed to calculate the total cost of producing the outcomes in question.

Such information is being sought by policymakers around the world as they try to answer questions about what it costs to provide an "adequate" education. But such information is very difficult to obtain in large part due to controversies surrounding the conceptualization of the education production function. There are some who believe that it is fundamentally wrong to think of education in such stark "input–output" terms. Proponents of this view celebrate the uniqueness of each educative event and resist the idea that something as transcendent as education can be reduced to mechanistic production function models. Monk (1992) provides an overview of this longstanding debate. Even among those who accept the idea of an education production function, there is disagreement about how successful efforts have been to understand its properties (see Hanushek 1989, 1996; and Laine, Greenwald, and Hedges 1996).

Nevertheless, progress toward estimating education production functions has been made in the recent past (for a good example, see Ferguson and Ladd 1996), and it is likely that new insights will be revealed by further improvements in the quality of both the data and the statistical estimating techniques (Reschovsky and Imazeki 1998).

There have been several explicit efforts to apply the production function approach to the estimation of education costs, and one of the most recent studies was conducted by Professors Duncombe, Ruggiero, and Yinger at Syracuse University (Duncombe, Ruggiero, and Yinger 1996). Duncombe and his colleagues focused their attention on New York state and dealt explicitly with costs that stem from differences in scale (in the production of educational services) as well as with costs that derive from differences in the incidence of students with special needs. The nature of their inquiry forced them to focus on a single state, and it is not possible at this point to generate the state-by-state and region-by-region results that are available from the previous three approaches reviewed.

The production function approach is promising but remains limited by inadequate data and an incomplete theoretical specification (Hanushek1979; Hanushek and Rivkin 1997; Monk 1992). We suspect that future work on estimating cost of education indices will draw explicitly on the production function approach.

In the final section of this chapter, we provide comparisons of the various statewide cost indices that have been constructed nationwide and also offer some observations about remaining difficulties.

Comparisons of the Available Geographic Cost Adjustments

Chambers and Fowler (1995) provide a comparative analysis for the three major approaches that generate state-by-state estimates of educational costs. They adapted both the Barro and the McMahon and Chang models and constructed indices that pertain to the same geographic areas as they calculated for the TCI. Table 3-1 reproduces results for a

Table 3-1. —State and regional comparisons of alternative teacher cost indices, selected states, regions, and school districts

State	Barro	McMahon and Chang	Chambers and Fowler (TCI) (Regional)
Alaska			
Nonmetro	144.17	129.69	116.08
Metro	135.84	120.71	110.42
California			
Nonmetro	121.28	93.89	95.29
Riverside-San Bernardino	121.88	104.40	106.00
Metro	117.88	112.33	104.94
LA-Long Beach	129.78	122.22	117.46
San Jose	121.39	122.88	107.41
Anaheim-Santa Ana	127.40	123.83	118.38
San Francisco	125.66	143.64	108.43
Connecticut			
Nonmetro	115.97	93.96	106.06
Metro	123.32	124.63	114.37
Louisiana			
Nonmetro	70.50	88.40	80.43
Metro	76.97	93.46	86.46
Massachusetts			
Nonmetro	100.12	93.94	112.46
Metro	102.23	113.75	114.12
Missouri			
Nonmetro	72.11	84.14	85.15
Metro	90.97	89.35	100.06
New Hampshire			
Nonmetro	95.02	93.96	107.39
Metro	105.45	115.69	110.62
New York			
Nonmetro	100.89	94.12	98.45
Metro	112.37	100.10	103.68
NYC	123.07	124.38	127.02
Nassau-Suffolk	140.92	130.29	115.63
Oklahoma			
Nonmetro	75.82	82.30	83.10
Metro	78.41	88.69	88.87

Table 3-1. —State and regional comparisons of alternative teacher cost indices, selected states, regions, and school districts—Continued

State	Barro	McMahon and Chang	Chambers and Fowler (TCI) (Regional)
Utah			
Nonmetro	83.38	85.89	90.82
Metro	84.73	87.12	98.28
Washington			
Nonmetro	103.68	87.69	98.96
Metro	106.02	92.16	102.40
Seattle	105.03	107.08	115.21

SOURCE: Adapted from Chambers and Fowler (1995), table 4.4, page 59.

few states and school districts that were originally presented in the Chambers and Fowler (1995) report and provides insight into how these different indices compare with one another.

It is clear from table 3-1 that the indices are highly correlated. Chambers and Fowler calculated the correlations and found them to be on the order of + 0.7 between the Barro and the McMahon and Chang indices. The Barro index ranges between a low of 70.5 in the nonmetropolitan areas of Louisiana and a high of 144.17 in the nonmetropolitan areas of Alaska. According to this index, teacher salaries, controlling for experience and training levels, are 205 percent higher in the highest salary area compared with the lowest salary area. In contrast, McMahon and Chang who sought to calculate differences in the cost of living throughout the Nation found that their index varied between a low of 82.3 in nonmetropolitan areas of Oklahoma and a high of 143.64 in the San Francisco metropolitan area. According to this index, costs in the highest cost area of the Nation are 174 percent higher than costs in the lowest cost area of the nation.

Recall that Chambers and Fowler took into account additional influences on teacher salaries, including attributes of the teaching assignment. Their regional index varied between a low of 80.43 in the nonmetropolitan areas of Louisiana and a high of 127.02 in metropolitan New York City. Thus, the Chambers and Fowler index suggests that the costs in the highest cost area are 158 percent higher than the costs in the lowest cost area of the nation.

Given the nature of these indices, it is not surprising that the magnitude of the range decreases as we move from Barro to McMahon and Chang to Chambers and Fowler. The adjustments that each of these analysts generate progressively take into account a greater number of considerations. The nominal differences in spending vary the most; as more adjustments are made, the degree of variation drops. Assuming the adjustments are correct, the more adjusted indices are superior to those with fewer adjustments. However, as we have seen, much of the debate centers around the appropriateness of the adjustments.

It is interesting to consider places where there are discrepancies between the values shown for the TCI and the McMahon and Chang cost-of-living index. For example, consider San Francisco where the cost-of-living index is 143.64, suggesting that costs are indeed very high. The TCI index is also high at 108.43, but not nearly to the same degree. What explains the discrepancy? The explanation offered by Chambers and Fowler is that the San Francisco area is commonly regarded as an attractive region of the country. It follows from the hedonic wage theory perspective that teachers are willing to work in this region for fewer salary dollars than would otherwise be the case. The TCI takes these perceptions of amenities into account and gives insight into the degree to which teachers are willing to accept the perceived pleasantries of San Francisco in lieu of salary amounts. The implication is that simply using the

cost-of-living index developed by McMahon and Chang would overstate the cost of attracting teachers into San Francisco. In other words, according to Chambers and Fowler, it does not cost as much to attract and retain teachers with a given set of capabilities into the San Francisco area as the McMahon and Chang index would suggest.

It is also interesting to examine places where the TCI is high relative to the estimated cost of living. In table 3-1, nonmetropolitan Connecticut, nonmetropolitan Massachusetts, metropolitan Missouri, nonmetropolitan New Hampshire, metropolitan Utah, and metropolitan Washington State all have TCI indices that are ten points higher than the corresponding cost-of-living index. This discrepancy suggests that these are places where amenities of either the region or the available teaching positions are low enough that salaries need to be higher in order to be attractive to teachers.

In table 3-2, we report differences between the TCI that Chambers and Fowler estimated using the 1990–91 SASS data and the GCEI that Chambers estimated using data from the same period. Recall that the GCEI differs from the TCI in that additional adjustments have been made for differences in the cost of administrators, noncertified personnel, and nonpersonnel inputs.

Comparing the Teacher Cost Index (TCI)and the Cost of Education Index (GCEI) across geographic locations for the 11 states displayed in table 3-2, we find that both indicators are within two units for 6 of the states. There are three states where the GCEI is more than two units higher than the corresponding TCI: Alaska, California, and Louisiana. The remaining two states' GCEIs are more than two units smaller than their corresponding TCIs: New Hampshire and Washington.

Table 3-2. —Comparisons between the Teacher Cost Index (TCI) and the Cost of Education Index across geographic locations (GCEI) state-level means (1990–91), selected states

State	Regional TCI	GCEI
Alaska	113.56	128.5
California	109.39	114.9
Connecticut	113.80	112.9
Louisiana	84.57	91.0
Massachusetts	114.06	113.1
Missouri	94.59	92.7
New Hampshire	108.71	104.9
New York	114.82	113.2
Oklahoma	86.60	88.2
Utah	96.58	96.0
Washington	105.84	102.8

SOURCE: Adapted from Chambers and Fowler (1995), table 4.1A, page 50 and Chambers (1998), table III-3, pps. 18–19.

SUMMARY

As we have seen, scholars vary substantially in the approaches they use to construct these cost indices, and policymakers must form their own judgments about which, if any, index to use for which purpose. Our emphasis in this chapter has been on cross-sectional differences in cost that are geographically based. In chapter 4, we turn our attention to changes in costs that can take place over time.

Chapter 4. Cost Adjustments Over Time

The difficulty of measuring expenditures between geographic regions pales when one's task is to separate inflation and the price of purchasing the same quantity and quality of an item over a long time period, such as a quarter-century. Why do we care about removing the effects of inflation from expenditures? Let us examine the effects of inflation on the income of two retirees, one of whom has a retirement plan that contains a cost-of-living adjustment (COLA), and the other who does not (table 4-1). Even assuming a modest 2 percent per year inflation over the next quarter-century, the retiree who retired in the year 2000, at a salary of $45,000 per year would be receiving 64 percent more in the year 2025, that is, a salary (in year 2000 dollars) of $73,827.

Actually, our simple example does not begin to reflect the inflation the United States has encountered over the 25-year period from 1972 to 1997, at least as measured by the Consumer

Table 4-1. — The effects of inflation over 25 years

Year	2 percent COLA salary		CPI-U*	CPI COLA salary	
2000	$45,000		41.2	45,000	
2001	$45,900	2%	42.8	46,804	4%
2002	$46,818	2%	46.6	50,960	9%
2003	$47,754	2%	51.8	56,646	11%
2004	$48,709	2%	55.5	60,693	7%
2005	$49,684	2%	58.7	64,192	6%
2006	$50,677	2%	62.6	68,457	7%
2007	$51,691	2%	68.5	74,909	9%
2008	$52,725	2%	77.6	84,860	13%
2009	$53,779	2%	86.6	94,702	12%
2010	$54,855	2%	94.1	102,913	9%
2011	$55,952	2%	98.2	107,333	4%
2012	$57,071	2%	101.8	111,306	4%
2013	$58,212	2%	105.8	115,663	4%
2014	$59,377	2%	108.8	118,998	3%
2015	$60,564	2%	111.2	121,640	2%
2016	$61,775	2%	115.8	126,680	4%
2017	$63,011	2%	121.2	132,531	5%
2018	$64,271	2%	127.0	138,855	5%
2019	$65,557	2%	133.9	146,446	5%
2020	$66,868	2%	138.2	151,139	3%
2021	$68,205	2%	142.5	155,860	3%
2022	$69,569	2%	146.2	159,897	3%
2023	$70,960	2%	150.4	164,480	3%
2024	$72,380	2%	154.5	168,955	3%
2025	$73,827	2%	158.9	173,775	3%
Total percent change		64%			286%
Average annualized rate of growth		2.00%			5.55%

* CPI-U adjusted for school years.

SOURCE: Author's illustration.

Price Index for all Urban consumers (CPI-U). The CPI-U increased 286 percent during this time, or almost 5.6 percent per year, reflecting the very high inflation of the late

1970s. Thus, our poor retiree with the unadjusted-for-inflation salary would, if the 2000–2025 time period experiences the same inflation as the 1970–95 period, become a pauper by having his income cut in half if he lived only 15 years after retiring, and had no other income or annuities.

How is the Consumer Price Index computed? Two indices are reported by the Bureau of Labor Statistics (BLS) of the U.S. Commerce Department. The CPI-U covers approximately 80 percent of the total population; while a Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W) reports index numbers for 32 percent of the population. Prices for goods and services of a "market basket" that are used to calculate the CPI-U are collected in 85 urban areas throughout the country, and from about 1,000 retail and service establishments (see table 4-1). Data on rents are collected from about 40,000 landlords or tenants and 20,000 owner occupants are asked about their housing units. The weight for an item is derived from reported expenditures on that item as estimated by the consumer expenditure survey. For the current Consumer Price Index the expenditure information was collected over 3 years—1982, 1983, 1984. In each of the three years, 4,800 families provided spending information quarterly. Another 4,800 families kept diaries listing everything they bought during a 2-week period.

The Consumer Price Index is an average change in prices that often does not reflect the experience of rural residents, the poor, or the elderly. It is usually updated every decade or so. There have recently been suggestions that the Consumer Price Index overreports inflation, and, in fact, that inflation has been about one percent less per year than reported, (or, for our purposes, 25 percent less over the quarter-century). Part of the reason for this stems from measuring items on sale, and then reflecting their nonsale price as inflation. However, there is a much more difficult problem

in measuring inflation over time that we now turn to: controlling for changes in the quality of a purchased item.

Changes in Quality of an Item Over Time

Let us begin with a simple example, shown in table 4-2. Let us assume the purchase of a fine automobile in 1970, at the impressive price (in 1970 dollars) of $5,000. Suppose the only new safety innovation included with the 1970 auto was tubeless tires and seatbelts.

By 1980, the price of the automobile had risen to $8,925, a 78.5 percent increase. However, the 1980 auto contained not only tubeless tires and seatbelts, but also shoulder har-

Table 4-2. —Changes in quality of an item over time

Year	1970	1980	1990	1995
A. Automobile				
Price	$5,000	$8,925	$25,900	$32,485
Change		78.5%	418.0%	549.7%
Features	seatbelts	seatbelts	seatbelts	seatbelts
		shoulder harnesses	shoulder harnesses	shoulder harnesses
		disk brakes	ABS brakes	ABS brakes
			airbags	airbags
				side airbags
B. Personal Computer				
Price	NA	$5,000	$3,385	$1,980
Change			-32.3%	-60.4%
Features		DOS	Windows	Windows95
		1 meg RAM	8 meg RAM	16 meg RAM
		<33 MHz	66 MHz	133 MHz
		600 baud modem	14.4 modem	28.8 modem
		10" b&w monitor	14" color monitor	17" color monitor
			4X CD-ROM	6X CD-ROM stereo speakers

SOURCE: Author's illustration.

nesses and disk brakes. By 1990, the price of the auto had risen to $25,900, a 418 percent rise, but that auto now added the safety features of ABS antilock brakes, and a driver's side airbag. By 1995, the auto was $32,485, a 549.7 percent price rise from 1970, but it contained tubeless tires with center groves, seatbelts, shoulder harnesses, ABS antilock disk brakes, driver and passenger dashboard airbags, side-impact airbags, and a side-impact collision bar.

The point of this laborious example is that the safety features of the automobile changed along with the price during the 25-year period. One could make estimates of how much "value" has been added, simply for safety, and attempt to remove this contribution from the price. However, the dilemma is that 25 years ago, a person could not have purchased an automobile with all the 1995 safety features at any price! Of course, the example ignores the real changes in automobiles over the quarter-century, in which the standard automobile now has overhead valves, climate control, power steering, power brakes, electronic ignition, almost maintenance-free greaseless fittings, fuel injection, keyless remote entry and ignition disconnect, does not require a tune-up for 100,000 miles, and many other features that were not present in the 1970 automobile.

Another dilemma is that, over time, quality can rise, and the price of an item can fall as, for example, the price of personal computers (which we begin in 1980). By 1995, a personal computer with far more capabilities than the 1980 computer cost about 60 percent less. Models now selling as commodities in discount stores are 100 times as fast as the 1980 machine, include a technology not available in 1980 (CD-ROMs), and contain a bundle of software that would have cost more than $1,000 (if available) in 1980. This poses another problem over 25 years for indices that use market baskets. The items purchased are different in 1970 and 1995. In 1970, word-processing would have been

accomplished with a typewriter. In 1995, word-processing uses a PC and a laser printer. Copies may be distributed on e-mail, and via Internet. Does one represent the typewriter function in 1970 by determining what proportion of the PC and laser printer are used, and perhaps, what the word-processing software cost? How does one represent reproduction and distribution costs, now electronic?

ITEM SUBSTITUTION

The typewriter example also highlights the dilemma of item substitution, which we briefly touched upon when explaining that the CPI-U is thought to exaggerate the inflation that has occurred by about one percent per year. In 1996, the last typewriter producer in the United States ceased their production. If the CPI-U has typically measured the purchase of typewriters for word processing since 1970, it now must change the item in its market basket and accomplish this replacement with as little disruption or distortion in the index as possible.

Substitution of an item for another by a consumer can be accomplished in a wide variety of ways. Assume that a purchaser buys a box of six chocolate-covered ice creams on a stick for her children every week. If her children's favorite brand goes up excessively in price, she might:

- choose another brand that is less expensive;
- purchase ice cream sticks that are smaller;
- purchase a less-expensive box with only four ice cream sticks;
- find a store where the price is less;

- change the frequency of her purchases, by only buying when the weather turns warm;
- substitute chocolate-covered yogurt sticks as an ice-cream substitute (presuming they are cheaper);
- substitute chocolate-flavored ice-cream cake, which provides more food at the same cost.

In short, substitution of an item that becomes too expensive for another that is less costly is a pervasive phenomenon, which may be accomplished in a multiplicity of fashions. Of course, the manufacturer might also make substitutions, by charging the same (or more) for smaller chocolate ice cream sticks, or fewer in a box. In this way, substitution can be as problematic as changes in the quality of an item for those using a market-basket approach.

In December, 1996, the Advisory Commission to Study the Consumer Price Index (commonly known as the Boskin Commission) recommend the use of a geometric mean formula to help correct "substitution bias." Not recognizing substitution of lower-priced goods or services tends to overstate the rate of price increases consumers' experience. The Bureau of Labor Statistics adopted this change effective with data for January, 1999, for components of the Consumer Price Index for all Urban Consumers (CPI-U) and the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W). It is anticipated that the use of the new formula will reduce the annual rate of increase in the Consumer Price Index by approximately 0.2 percentage points per year. Those seeking publications and explanations of this change are urged to visit the Bureau of Labor Statistics Internet (BLS) web page, at URL http://www.bls.gov/.

DIFFERENTIAL GROWTH OF MARKET BASKET COMPONENTS

Another troubling aspect of the CPI-U is that the various components of the market basket demonstrate different inflation rates (Rothstein and Miles 1995, 9–16). Rothstein and Miles calculate that inflation in medical care from 1967 to 1991 was 681 percent, while the inflation for all items was only 408 percent, a difference of 273 percent over the quarter century! Their point is that a family that had to purchase an above-average amount of medical care would have encountered a higher rate of inflation than the national average CPI-U. This would also be true for consumers who purchased items not in the market-basket, such as private planes, or yachts, or whose purchasing profiles differed from the 4,800 families who completed the consumer expenditure survey.

Thus, market basket approaches to assessing inflation have difficulty with item substitution and changes in quality of an item. Even if these problems are resolved, the resultant index is simply the "average person's" index. As such, it is only a rough approximation of the change in prices that have occurred for the market basket in the nation, or for one of the 85 urban areas throughout the country. This presents another problem. New Jersey, for example, is between two major metropolitan areas, Philadelphia and New York. How does one estimate the inflation that has occurred for the state? What if one wishes to measure inflation for the last decade in New Brunswick, New Jersey, roughly equidistant from Philadelphia and New York? Further, resort communities such as Tony Stone Harbor, New Jersey, on the Jersey shore, may have an inflation rate vastly different from both Philadelphia and New York.

Even if the CPI-U were entirely appropriate for use as an educational deflator, problems in construction and maintenance of the market basket, and the lack of comparability between types of consumers and geographic locations, and the lack of reporting specificity would pose serious obstacles to the use of the CPI-U as a utilitarian deflator. Before we turn to indices that might be more appropriate for education, it is important to think about school district spending.

SCHOOL DISTRICT SPENDING

Earlier we suggested that the reader focus on how job characteristics influence geographic cost differences in a single year. However, job characteristics can influence wages over time. Let us examine how this occurs. Most of the cost of providing public education are personnel costs, such as providing employees' salaries and fringe benefits.[11] Salaries average about 65 percent of total current expenditures, and employee benefits about another 16 percent; together these two categories are responsible for over 80 percent of a school district's expenditures (Fowler 1993). Purchased professional services, which in part acquire the services of professionals,[12] account for more personnel expenditures, as does purchased property services[13] and student transportation. Supplies are truly minor in such an enterprise.

Although supplies represent less than 6 percent of all current expenditures for the average school district, the first

[11] Such as retirement, Social Security contributions, medical and group life insurance, unemployment, tuition reimbursement, workman's compensation, accrued sick leave, and professional dues and fees.

[12] Such as architects, engineers, auditors, dentists, medical doctors, lawyers, consultants, computer programmers, psychologists, social workers, and accountants.

[13] Examples are utility and cleaning services, snow plowing, custodial services, lawn care, and repair and maintenance.

work on cost indices was undertaken to understand the differences in the costs of supplies that school districts in differing geographic areas might encounter (Furno and Cuneo 1971). In one sense, the work was undertaken because the quality of school supplies differs minutely. The category "supplies" has a very specific meaning to accountants. They are materials that are consumed and have a life of less than 1 year, in contrast to equipment, which is more durable. Examples of supplies include Xerox paper, personal computer diskettes, and student workbooks. While some may wish to debate the attributes of one brand of personal computer diskettes over another, most persons will generally concede that they are interchangeable.

The personnel that staff school districts, however, are certainly not interchangeable, and have vastly different attributes, even if one compares them on such uniform characteristics as educational attainment, and occupational experience for the purpose of a uniform salary schedule. School districts have much more discretion over their personnel expenditures than one might suppose. School districts can choose to employ better educated, more experienced staff, reduce class size, or hire more male professionals (who seem to receive higher compensation—see Chambers and Fowler 1995). In addition, Rothstein and Mishel (1997) argue that what schools pay teachers also reflects the pay of comparable (college-educated or professional) workers, although Chambers and Fowler believe this effect is more pronounced with school district non-certified staff than with certified staff.

To understand how school districts might manipulate their personnel costs, consider for a moment the complexity of the school district personnel environment. Salary expenditures may be determined by competition between school districts, but every individual teacher's salary is subject to placement on the salary guide, what courses and degrees

might be used to place them on the salary guide, and whether performance might be used as a mechanism for "step increases." Duty periods might be changed to preparation periods, and the number of classes taught each day might differ from the "standard load." The number of students assigned to a individual teacher might differ, perhaps according to subject matter, or because of the assignment of especially needy students. Certain teachers may receive only "advanced placement" students to teach.

In addition to these considerations for an individual teacher, there are system-wide personnel considerations. In general, the more specialized and fragmented teaching resources are, the more expensive the operation (Miles and Darling-Hammond 1998). Is there additional compensation for some duties, or clubs, or coaching? Is there an incentive program for husbanding sick leave (in order to reduce the cost of substitutes)? How freely are sabbatical and other leaves awarded? Are large numbers of specialized teachers frequently used outside regular classroom with specifically defined numbers of students?

Rothstein and Mishel (1997) explain that, as a result of inflation, a school district would need to *increase* pupil/teacher ratios, rather than decrease them, simply in order to maintain the status-quo. Of course, if pupil/teacher ratios are allowed to decline, then more resources are required.

> *...a school with a pupil/teacher ratio of twenty to one that pays teachers $20,000 annually will be spending $1,000 per pupil (assuming, of course, there are no other expenses than teachers). If wages in the economy, and for teachers, grow 10% then spending per pupil will also rise 10% to $1,100. The cost efficiencies necessary to offset higher wages requires that the numbers of pupils per teacher rise to 22.2. Schools then are faced with a continuous rise in the number of pupils per teacher or steadily rising spending per pupil (a measure of school costs, or inflation), at least when compared to other*

sectors which can achieve greater costs efficiencies over time (Rothstein and Mishel 1997) (Table B).

Since it is evident that education costs are predominantly personnel costs, it is necessary to ponder how school district spending may have changed over the last 25 years, particularly when considering personnel expenditures. It is to this notion that we turn next.

CHANGES IN SCHOOL DISTRICT SPENDING OVER THE LAST QUARTER-CENTURY

School districts are vastly different places in 1995 than they were in 1970, and nowhere is this clearer than in the use of personnel. School districts negotiate teacher compensation with unions, and the contract may guide both compensation and staff assignment. School districts employ teachers with much more experience and higher degrees than they did in 1970, although much of this may be due to the aging of the teaching force (Lankford, Ochshorn, and Wyckoff 1998). Staff to student ratios are much lower than they were in 1970. The number of students teachers have on their rolls is also much lower (U.S. Department of Education 2000, table 83). Teaching is more predominately female than it was in 1970. Contracted services are much more common, for food service, transportation, custodial services, and even nurses. School districts employ greater numbers of adults to assist teachers in the classroom, and to relieve teachers of certain student supervision duties, such as study hall, cafeteria duty, student detention, and teacher substitutes.

This change in the usage of personnel over time is somewhat similar to item substitution. That is, the 1970 teacher was younger and held fewer degrees (and thus was paid less), dealt with more students, worked in schools with

higher pupil/teacher ratios, and often drew student supervision duties and substituted for absent fellow teachers. Changes in all of these attributes and job requirements result in more difficulty in assessing how the "price" of a teacher has changed over the quarter-century.

This leads us to a discussion of what education cost adjustment over time have been used, and what an ideal education inflation cost adjustment may be.

EDUCATION INFLATION DEFLATORS

The Consumer Price Index (CPI)

We began our discussion of cost adjustments over time by discussing the Consumer Price Index for all Urban consumers (CPI-U). The NCES generally reports in the *Digest of Education Statistics* and *The Condition of Education* the national current expenditure per student, corrected for inflation by using the CPI-U as a deflator (See figure 1-1, page 9). Some researchers have regarded these figures and tables as endorsements by the NCES of the use of the CPI-U as an appropriate deflator. Rather, this has been a matter of pragmatism, as few other alternative deflators have been available over the time period. Certainly it is one of the few federal government inflation measures available from 1970 to 1999.

Let us again reflect upon the problems with the Consumer Price Index that arise from it being a market-basket approach. There are always questions concerning the construction and maintenance of the CPI-U market basket, which here is clearly not synonymous with an "education market basket." As with all market baskets, it is vulnerable to item substitution, and, above, we demonstrated that school district personnel have experienced something similar to item substitution, by having teachers perform quite

different work over the last 20 years. In addition, school districts have chosen to employ (or retain) better educated, more experienced staff, and to reduce class size. This, in essence, is the dilemma we earlier described using changes in automobile quality.

Various components of the CPI-U market basket demonstrate different inflation rates and it is unclear which should be applied to teachers' salaries. The Consumer Price Index also only reflects certain large metropolitan areas for school district inflation, which, even if correct, represents only the average for those types of school districts in the nation. Rural school districts would have different inflation rates.

In short, upon reflection, even the use of the national CPI-U deflator has drawbacks as a education deflator. Let us turn to other deflators that have been applied to education.

The School Price Index (SPI)

One of the first market basket approaches applied to elementary and secondary schools was formulated by D. Kent Halstead (Halstead 1993 and 1998). The School Price Index is constructed by devising the percentage weight of each of some 70 items that schools purchase. For example, if teachers' salaries comprise, on average, 50 percent of the average school district's budget, then teachers' salaries are weighted at 50 percent. The change in the average teachers' salary over a year is considered the growth inflation rate. Spending above this average would represent real spending.

National data bases, such as the Common Core of Data (CCD) education finance data base from the NCES, do not contain the detail from state administrative record systems to provide information on the approximately 70 items that comprise Halstead's index. In order to obtain the level of detail he uses, he has typically turned to a collection by a

private nonprofit, the Educational Research Service (ERS), of Arlington, VA. Educational Research Service has a convenience sample of school districts that wish to compare their spending profiles. There has never been a statistical determination of the difference between this sample and a national sample. However, for our purposes, let us suppose that the sample is nationally representative. Thus, if teacher salaries comprise 50 percent of the average school district's expenditures, then the average teacher salary gain reported by Educational Research Service would represent half of the inflation increase that the School Price Index would estimate for the year.

As with the CPI-U, various components of the market basket demonstrate different inflation rates. Teachers' salaries did not rise at the same rate as student transportation, for example. The School Price Index also only reflects a single national number for school district inflation, which, even if correct, represents only the average school district in the nation. Urban and rural school districts would have different inflation rates.

Of course, even if the above problems were not sufficient, the School Price Index may also suffer from a sample that is not nationally representative, from difficulties in constructing the relative weights for the index, from a lack of comparability between types of school districts and geographic locations, and from the use of a single national estimate for "elementary/secondary education inflation."

The Net Services Index (NSI)

Richard Rothstein, with Karen Hawley Miles, was engaged in a study of the expenditures of nine school districts over roughly 25 years. For many of the reasons cited above, Rothstein and Miles rejected both the CPI-U and the School Price Index as a deflator, that is, as a way of removing inflation from the spending of the school districts over the quar-

ter-century. They came to believe that education is an example of a sector in which inflation will outpace the average inflationary trend, just as medical services expenditures rise more rapidly than manufacturing expenditures. The reason for this, they speculate, was first described by the economist William Baumol (Baumol 1967), who believed that inflation increases more rapidly in sectors with low productivity. Rothstein and Miles refer to the faster inflation in slow productivity sectors as the "Baumol effect." Common examples they use to illustrate the "Baumol cost disease" are barbers and orchestras. Barbers have a difficult time cutting an increased number of heads, and thus their productivity does not rise as fast as auto workers who though fewer in number become more productive as firms take advantage of automation and other labor saving innovations. Members of orchestras face a similar difficulty since playing multiple instruments simultaneously or playing the music "faster" are not viable means of enhancing productivity. Even so, the salaries of orchestra musicians must rise in response to productivity gains elsewhere in the economy in order to attract and retain "first string" talent into orchestras from highly competitive labor markets. The result of these increases in salaries in the face of unchanged levels of output is a reduction in productivity.

Education, Rothstein and Miles argue, would have had to *increase* the pupil/teacher ratio, rather than decrease it, to achieve comparable productivity gains to manufacturing. From 1967 to 1991, manufacturing achieved a 40 percent productivity growth, about 1.4 percent a year. The pupil/teacher ratio in 1967 was 20:1. To match the 40 percent manufacturing productivity increase, the pupil/teacher ratio would have had to rise to 28:1.

A related insight of Baumol was that

> *"...we must increasingly spend a larger share of our incomes on low productivity goods and services that have more rapid price increases (like education), just to maintain the same level of our consumption" (Rothstein and Mishel 1997, 176).*

Rothstein and Miles argue that this insight by Baumol means that using the CPI-U as an education deflator would systematically understate the inflation facing school districts, which would overstate how much "real" expenditures have grown. To solve this problem, they devise their own subindex of the services portion of the CPI-U, which they call the Net Services Index (NSI).[14]

The Net Services Index removes shelter and medical care from the CPI-U. The remaining components are such items as entertainment services, personal care services, personal and (private school) educational services, public transportation, auto repair, private transportation (other than cars), housekeeping services, and utilities and public services. These are all labor-intensive services (like public elementary/secondary education), and may be low in productivity growth. The Net Services Index still understates school inflation, Mishel and Rothstein believe, because none of these Net Services Index labor-intensive services requires well-educated workers to the degree that public lower education does. Nevertheless, a national index number for the Net Services Index was constructed for certain years (1977–82; 1982–86; 1986–90) from December 1966 to 1990.

An advantage of the Net Services Index is that regional indices can also be devised. Bureau of Labor Statistics provides indices for major urban areas and for cities within each region. Since Rothstein, with Miles, was studying nine school districts, nine regional indices were constructed: Bal-

[14] With the assistance of Patrick Jackman, Chief Economist of BLS.

timore (for Anne Arundel school district); North Central C-size (for Bettendorf school district); Denver (for Boulder school district); South D-size (for Clairborne school district); South C-size (for East Baton Rouge school district); Boston (for Fall River school district); Los Angeles (for Los Angeles unified); New York City (for Middletown school district); and Houston (for Spring Branch school district).

Notwithstanding the care with which the Net Services Index (and its subindices) has been constructed, the Net Services Index has essentially all the many faults of any market-basket index. However, some economists criticize the Net Services Index, because it is, in their opinion, like comparing a sick person's health to those hospitalized, rather than to healthy persons. Few educators should seek to emulate the reductions in productivity demonstrated by those industries that exhibit "cost disease," and thus, few would want an index that "benchmarks" such low productivity. Indeed, the decrease in pupil/teacher ratio, without obvious outcome gains, such as superior student achievement scores, suggests to some economists that education is exacerbating its productivity losses (Hanushek 1997, 185–95).

Inflationary Cost-of-Education Index (ICEI)

Chambers (1998) has modified the hedonic Teacher Cost Index by expanding it to include school administrators and noncertified staff, employing 3 years of the SASS, 1987–88, 1990–91, 1993–94. This permits a 6-year inflation index, as well as a geographic cost adjustment to be devised. Since this inflation index controls for the hedonic components of cost, as well as the discretionary actions of school districts, it is possible to compare the growth in educational expenditures over time with the other deflators discussed here, such as the CPI-U and the Net Services Index. Such a comparison is useful in understanding how different deflators

lend themselves to a different interpretation of the amount of resources that have been devoted to education.

The Employment Cost Index

The Employment Cost Index (ECI) measures the rate of change in employee compensation, which includes wages, salaries, and employers' cost for employee benefits. The Employment Cost Index includes employee benefits, in addition to wages and salaries, and covers all establishments and occupations in both the private nonfarm and public sectors (with the exception of federal government workers). The index is computed from data on compensation by occupation collected from a sample of establishments and occupations weighted to represent the universe of establishments and occupations in the economy. All earnings are computed on an hourly basis, whether or not this is the actual basis of payment, and salaried positions are converted to an hourly basis. Shifts in employment among jobs and establishments are controlled by measuring wage change for the same jobs in the same establishments and applying fixed employment weights to the results. The benefit data encompasses paid leave, supplemental pay, insurance, pension and savings plans, and legally required benefits (unemployment insurance and workers' compensation). The Employment Cost Index is extensively used as a major economic indicator in determining monetary policy (e.g., regulating the money supply) by the Federal Reserve Board, and the Council of Economic Advisers often cite the Employment Cost Index in their analyses of inflation and of productivity in the U.S. economy in the *Economic Report of the President*. Since 1991, the Employment Cost Index is used to adjust the pay of the House and Senate, federal judges, and federal government employees.

The Employment Cost Index is of interest because a subscale of employees is available, that is, local government work-

ers in education. This captures most school district employees. The Employment Cost Index subscale from the Bureau of Labor Statistics is available from 1981 to 1996. In addition, the Employment Cost Index can separate salaries and fringe benefits.

CHOOSING AN INDEX FOR COST DIFFERENCES OVER TIME

We began the chapter by looking at inflation for the nation, for the 25-year period from 1970 to 1995, using the Consumer Price Index for all Urban consumers (CPI-U). We now know that the CPI-U is based upon a market basket approach, which struggles with item substitution and changes in the quality of an item over time, and demonstrates components of the market basket (such as medical care) that rise much more rapidly than the overall index. We also understand that the CPI-U reflects the experience of the average consumer, and so rural residents, the poor, or the elderly may encounter different rates of inflation. Most importantly, however, the CPI-U does not sufficiently capture inflation in education, simply because it is not a market basket component.

Halstead's School Price Index is a market basket specific to education. However, it also struggles with changes in the use of educational personnel over time, which we might interpret as item substitution. In addition, changes in the characteristics of staff (such as higher degree status and experience) and smaller class sizes are similar to quality changes for which the School Price Index cannot control. Certainly the market basket components of the School Price Index increase at differential rates. Perhaps most troublesome is that we cannot be certain that the School Price Index is nationally representative. Finally, we have only a single

national estimate, which certainly will not suffice for certain (i.e., urban or rural) school districts.

Rothstein's and Miles Net Services Index create their own subset of the CPI-U, but for all the reasons cited above with other market basket inflation measures, we find other indices with which to accomplish deflation that do not have the difficulties of market basket deflators. It does have the virtue, however, of having regional indices that can also be devised. Perhaps more troublesome is whether we wish to use an index that is benchmarked against industries that are already known for having a "cost disease." The lowering of the pupil/teacher ratio over time may suggest that education has purposely lagged behind in productivity gains. What would be the response, for example, if barbershops added additional barbers who were idle, and paid for them by increasing the price of haircuts?

Chambers and Fowler's Teacher Cost Index is a first step toward an education cost adjustment, and the success of the Inflationary Cost-of-Education Index in incorporating both school administrators and noncertified staff presumes a significant advancement in measuring education costs over time. However, it is only for a 6-year time period, and so it is useful primarily as a gauge of the degree to which other inflation estimates differ. The Inflationary Cost-of-Education Index might be criticized by Ladd (1998), who counters that the Teacher Cost Index (and, by extension, the Inflationary Cost-of-Education Index) does not, like her own price adjustment, take into account the difficulty of student educational needs in measuring a school district's expenditure.

The education subindex of the Employment Cost Index (ECI) has many elements that make it attractive: a 15-year time span; information on employee benefits, as well as salaries; and regional subindexes. Nevertheless, the Employment

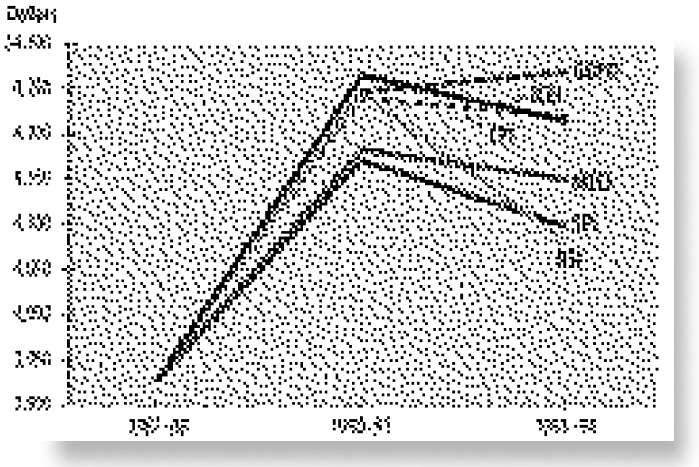
Cost Index does not control for the discretionary factors affecting school district costs, nor does it control for the personnel equivalent of "item substitution."

As may have now become apparent, there is no perfect inflation index to use as a deflator when wishing to remove the effects of inflation from education cost increases over time. An education finance researcher must weigh the time period to be adjusted against the indices available, and whether or not regional- or school district-specific indices are required.

In addition, we must consider whether to accept the arguments and logic of Baumol, and be ready to concede that education will have low productivity growth and few cost efficiencies, and where the average citizen must increasingly spend a larger share of their income to achieve the same level of output. Rothstein and Mishel (1997) also argues that the uses of an education-specific inflation index are limited, in comparison to a "child-services" inflation index, for example.

Chambers (1997) provides a comparison of many of the indices we have discussed here. In figure 4-1, Chambers plots the Consumer Price Index (CPI), the Gross Domestic Product Deflator (GDPD), the School Price Index (SPI), the Net Services Index (NSI), a Modified Employment Cost Index (MECI), and his Inflationary Cost-of-Education Index (ICEI). Notice that from 1987 to 1993, the Net Services Index shows the least percentage change (12.9 percent), while the Gross Domestic Product Deflator shows the highest percentage change (18.1 percent), a difference of 5.2 percent or 0.86 percent per year. While a roughly 1 percent difference in these measures may lead to differing interpretations over very long time periods, such as a quarter-century (25 years), the differences between them over shorter periods are minor.

Figure 4-1. —Per pupil expenditures adjusted by alternative measures of inflation



SOURCE: *Measuring Inflation in Public School Costs.* Washington, DC: December, 1997. NCES Working Paper No. 97–43.

By now, we are certain that our readers think it probably does not matter which inflation index is used to measure education costs. As we will demonstrate in the next chapter, the choice of inflation index to use as a deflator influences the conclusions reached by educational researchers debating the extent to which new resources were available for school districts over the last 25 years.

Chapter 5. Using Geographic and Inflation Deflators

In this chapter, we apply selected geographic and inflation cost-adjustments to nominal (actual) expenditures, in order to illustrate the differences obtained, and to illustrate that the choice of a particular geographic or inflation deflator may influence the conclusions reached by education finance researchers.

Geographic and Inflation Cost Adjustments

Let us turn first to two geographic cost adjustments for the Washington, DC metropolitan statistical area, one a "cost-of-living" adjustment by McMahon and Chang (1991), and the other, the Teacher Cost Index, a "hedonic" adjustment by Chambers and Fowler (1995). As previously described, the cost-of-living geographic cost adjustment provides estimates based upon 1990 Census demographic data, mapped to school-district boundaries defined by the National Center for Education Statistics (NCES). The adjustments for school districts are contained in an index number that

runs from 108 to 126, which suggests that school districts in this area have costs that are from 8 percent to 26 percent above the average school district in the Nation (table 5-1). The cost-of-living index is based upon the labor market characteristics for a larger geographic area than a single school district, which sometimes results in the same index adjustment for individual school districts. For example, Calvert, Montgomery, and Prince George's counties in Maryland all show cost-of-living indices of 108 (8 percent).

Table 5-1.— Washington, DC metropolitan statistical area geographic cost adjustments

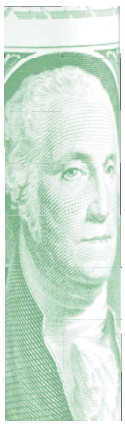
School district	Teacher Cost Index cost-adjustment	McMahon cost-adjustment
Falls Church City (VA)	89.5	113.3
District of Columbia	101.7	125.5
Stafford County (VA)	103.3	113.3
Loudoun County (VA)	103.1	113.3
Prince Georges County (MD)	104.5	108.3
Calvert County (MD)	104.9	108.3
Manassas Park City (VA)	107.5	113.3
Prince William County (VA)	106.5	113.3
Manassas City (VA)	108.9	113.3
Montgomery County (MD)	108.1	108.3
Fairfax County (VA)	110.7	113.3
Alexandria City (VA)	108.3	113.3
Arlington County (VA)	110.6	113.3

SOURCE: Fowler, William J. Jr. and Chambers, Jay. 1995. *Public School Teacher Cost Differences Across the United States*. Washington, DC: U.S. Department of Education, National Center for Education Statistics, NCES 95–758.

Chambers' Teacher Cost Index cost adjustment, based upon his hedonic methodology, results in school district specific indices. For example, Prince Georges and Calvert have Teacher Cost Indices of 105, while Montgomery has a Teacher Cost Index of 108. The most dramatic differences, however, appear for two school districts: the District of Columbia and Falls Church. Even more troubling, the two

index corrections are in different directions, that is, McMahon finds Washington, DC with an enormous 25 percent higher cost than the nation's average school district, while Chambers shows it as only having 2 percent higher costs. McMahon concludes that Falls Church has costs 13 percent higher than the nation's average, while Chambers concludes that Falls Church's costs are 11 percent *lower* than other school districts. Let us turn to how these researchers arrive at these contrary findings, and the implications of such dramatic differences.

McMahon bases his findings upon a regression that includes the median value of owner-occupied housing, the per capita personal income, and the percent change in population over the preceding decade. Chambers obtains his findings from an analysis of teacher characteristics, and the cost to employ similar school personnel with similar characteristics into similar job assignments. In addition, he considers the amenities of urban and rural life. He particularly excludes cost-of-living variables such as housing and personal income, but considers such job amenities as pupil/teacher ratio. One way of looking at these different perspectives is to realize that housing and average income in Washington, DC are quite a bit above national figures. The median value of owner-occupied housing in 1990 in the District of Columbia is $121,665, compared with a national median in 1990 of $78,500, and the 1990 median household income is $30,927, compared with the national median income in 1990 of $30,006. Chambers' model, however, recognizes that teachers employed by the District of Columbia might not live there. As a result, his analysis shows that the cost of hiring equivalent teachers in Washington, DC is only 2 percent higher than the national average. Why might teachers not be as costly as the cost of living? Chambers responds that teachers may be willing to trade salaries for the amenities of living in the Washington, DC metropolitan area,



and in recognition of the metropolitan competitive labor market. In addition, they may be able to reside in Fairfax, Montgomery, or Prince George's counties, effectively lowering their cost of living, but still retaining many of the amenities of the Washington, DC metropolitan area, choosing to commute.

Most educators would suggest that the District of Columbia Public Schools (DCPS) is a high spending school district with a high cost of living. The high expenditures, educators would anticipate, would be to attract and retain comparable staff with its surrounding suburban school districts, particularly in light of such disamenities as violence and safety issues. Those beliefs would fly in the face of Chambers' index showing less than a 2 percent geographic cost adjustment, and lean toward confirming McMahon's 25.5 percent cost adjustment. However, the reader is reminded that Chambers is attempting to compare the cost of employing similar staff. DC teachers do not have similar training and experience levels, nor comparable salaries, to teachers in the DC suburbs. For example, for the year 2000, a teacher with an M.A. and the maximum experience level receives $57,454 in DC, $61,383 in Alexandria, and $66,435 in Fairfax (Fairfax County School Board Auditor 1999). Experienced teachers often leave the DC public schools for the amenities of the surrounding suburban school systems. In addition, the District of Columbia Financial Control Board found that much of the funding is not reaching the classroom. The DCPS employed 16 teachers for every central administrator employed, compared with its peer districts, who employed 42 teachers for every central administrator (Ladner 1998).

The reader who has followed the alternative arguments thus far may be willing to accept the researchers' differing findings regarding the District of Columbia, but may still be puzzled when examining the differences for the tiny (1,214

student) school district of Falls Church, VA. The reported current expenditure per pupil (CEPP) for Falls Church in the 1991–92 school year was $8,660, even higher than Washington, DC's reported $8,404. Applying McMahon's 1.13270 cost-of-living index to the reported current expenditure per pupil (8,660/1.13270), we obtain a cost-adjusted per pupil expenditure of $7,645. In other words, McMahon would reduce the reported expenditure by $1,015 (about 12 percent, with rounding), in order to reflect the lower purchasing power of the school district's expenditures.

Applying Chambers' Teacher Cost Index of 0.89490 to the current expenditure per pupil ($8,660/0.89490), Chambers obtains a cost-adjusted per pupil expenditure of $9,677, or $1,017 *more* than the reported expenditure. How can a school district effectively spend *more* on acquiring comparable teachers? Chambers responds that the pupil/teacher ratio in Falls Church of 13.5, compared with such neighboring school districts as Fairfax, with a pupil/teacher ratio of 16.1, or Washington, DC, with a pupil/teacher ratio of 16.9, demonstrates that Falls Church, a small, high-spending school district, is using its resources to create even better job amenities for its teaching staff. Chambers' view would be that Falls Church is able to attract and retain comparable teachers better than any of the school districts in the DC metropolitan area, offering them not only superior salary and benefits, but also smaller class sizes.

STABILITY OF THE GEOGRAPHIC COST ADJUSTMENTS

Chambers raises an issue of the stability of his school district geographic indices in his latest Cost of Education Index across geographic locations work (1998). Table 5-2 demonstrates Chambers' hedonic Teacher Cost Index and Cost of Education Index across geographic locations cost

Table 5-2. —Comparison of Chambers cost adjustments

School district	Enrollment	Teacher Cost Index	Cost of Education Index across geographic locations	Difference
Chicago	408,830	120.7	110.5	-10.2
Philadelphia	190,979	116.1	101.8	-14.3
Detroit	168,956	110.6	99.6	-11.0

SOURCE: Geographic Variations in Public Schools' Costs. February, 1998. Washington, DC: NCES, Working Paper No. 98–04., p. 33

adjustments for three of those school districts with enrollments greater than 100,000 students.

As Chambers' acknowledges, differences in the regression components and other "refinements" in his statistical approach are most apparent in Chicago, Philadelphia, and Detroit, where the differences between the index numbers are 10.2; 14.3; and 11.0, respectively. In short, the earlier Teacher Cost Index would have overestimated the geographic index number, resulting in a 10 to 14 percent greater reduction in the nominal per pupil expenditure from the latest hedonic approach.

Such large differences in the geographic cost adjustment index numbers are troubling. Although the later GCEI incorporated a variety of new variables and expanded the staff to include principals and other staff, 10 to 14 percent fluctuations for some of the largest school districts might cause users to pause before utilizing the index numbers for such uses as state aid, to which we turn next.

Geographic Cost Adjustments and State Aid to School Districts

Another application of geographic cost adjustments is to modify state aid to school districts. Here there are two concerns; first how differing methodologies and index num-

bers might affect the amounts of state aid to a school district; and second uncertainty that school districts might respond in such a way as to influence the geographic cost-adjustment measurement, in a way to increase state aid to the school district.

Let us turn to how McMahon's and Chambers' indices might be used in a Virginia education state aid formula for the school districts of Falls Church and Danville. Virginia's general school aid formula is typical in the sense that property-wealthy school districts receive a smaller percentage of state aid than property-poor school districts. As seen in table 5-3, Danville's median value of owner-occupied housing is about one-fifth of that in Falls Church. As a result, Danville receives about 45 percent of its total revenue from the state, while Falls Church receives only about 7 percent. Many states have such general school aid patterns to assist poor school districts (although the actual formula may rely upon the local property wealth per student) (American Education Finance Association, National Education Association, and National Center for Education Statistics Forthcoming).

However, school districts in high cost-of-living areas often argue for additional state aid to offset these geographic costs.

Table 5-3. —Comparison of two Virginia school districts

School district	Danville	Falls Church
Per pupil expenditure	$4,231	$8,533
Median household income	$20,413	$51,011
Median value owner-occupied housing	$46,628	$223,006
Percentage revenue from state	44.6%	7.1%
Student/teacher ratio	15.6	12.8

SOURCE: U.S. Department of Education, National Center for Education Statistics, *Common Core of Data (CCD) School Years 1991–92 through 1995–96* (CD-ROM), Washington, DC: 1998, NCES 98–209.

Virginia, for example, included a cost-of-living factor of about 13 percent, by which it increased its general school aid to Falls Church.

McMahon would recognize the Falls Church school district as a geographically high-price area, receiving proportionally less state education aid than those districts in geographically lower-price areas, such as Danville. Chambers, however, would view Falls Church as a school district having such wherewithal that it is receiving proportionally more state education aid than a district such as Danville, which is in a geographically lower-price area. Table 5-3 displays the relevant profiles of both school districts.

For the majority of education finance researchers, Danville is more needy than Falls Church, when considering state education aid, and a cost adjustment should recognize this. The State of Virginia's 12.89 percent adjustment is designed to reflect these additional needs.

McMahon is concerned that the Chambers' cost adjustment might lead to "cost endogeneity," that is, that the local school district may influence future state aid, increasing it by adjusting its behavior in some way that is under the control of the school district (McMahon 1996). He believes that a school district cost adjustment (and even a regional cost adjustment) based on local teachers' and administrators' wages is vulnerable to just such manipulation, inviting "inefficiency and … disaster" (McMahon 1996, 95). Rather, he asserts that a cost-of-living index (such as his own) reflects conditions that are outside the school district's control. This is particularly true, he believes, since school district expenditures and state reimbursements would constitute such a small proportion of the expenditures that compose the cost of living in an area. Amenities, such as proximity to major cities, cultural events, pleasant neighborhoods, and resort locations are incorporated into local price

levels. McMahon also asserts that the Teacher Cost Index includes diseconomies of small scale, and if these costs are reimbursed, a "Falls Church" has no incentive to merge to reduce the its costs. Finally, he argues that because education is such a human-capital intensive operation, the cost-of-living "… is more likely to approximate the true cost of living faced by teachers and administrators with comparable skills in different localities …" (McMahon 1996, 97).

The Virginia adjustment of 12.89 percent in costs for nine Northern Virginia school districts is an attempt by the state to address all these issues. It provides a paradigm of the difficulties involved in adjusting state aid formulas for geographic cost differences. As we noted in the original Washington, DC metropolitan area example, the cost of living may not be an accurate reflection of the cost of employing comparable staff in comparable positions. While McMahon may argue that these nine school districts have the same cost of living, Chambers would respond that they may not, using Falls Church as an example.

We originally began this discussion by raising twin concerns: the amount of state aid a school district receives, and how it might influence that amount. In the Virginia adjustment, the nine school districts in the high-cost area are receiving state aid of about 13 percent more than they would receive if they were located elsewhere in the state, such as the Norfolk metropolitan area. If these school districts had low expenditures, and slight fiscal capacity, no one could object to such an adjustment. However, when we examine the wealth of these nine school districts, in comparison to a "Danville," we find them very well situated. Thus, the adjustment would seem to be more disequalizing, than equalizing, in terms of achieving per pupil expenditure equity in the state of Virginia.

What of the other concern, how school districts might influence the Virginia cost adjustment? The nine school districts might assert that the cost-of-living differential is really the 25 percent higher cost of living that McMahon finds for the District of Columbia, to which they are proximate. They might then lobby their state legislators to include them in the number of school districts that receive a cost adjustment. The nine school districts might also opt to run a higher-quality school system, through those things which the school district has control over, such as hiring more experienced and degreed male teachers, and maintaining low pupil/teacher ratios.

In short, the Virginia cost adjustment seems to suffer from the problems we do not want in a geographic cost adjustment used in a state aid formula, while having few of the virtues of one we would desire. Let us now turn to examples from other states.

Here we provide an overview of how various units of government at both the federal and state levels have made use of cost indices in the operation of their respective schooling systems. As we shall see, much of these existing efforts involve attempts to use geographically based cross-sectional adjustments to alter the flow of financial aid to schooling systems. The federal government as well as a number of states have begun explore this application of cost indices. Our purpose here is to report and not to make judgments about the various applications that have been made. Readers can judge for themselves the appropriateness of each application for their specific areas of responsibility.

In the latter portion of this chapter, we illustrate how cross-sectional indices can be used to assess a state's progress toward conventional measures of equity in school finance formulae. Our purpose is to demonstrate what has now be-

come possible and to encourage further refinement of the available adjustments.

The Use of Geographic and Inflation Cost Indices to Adjust Aid Flows

Both the federal government and a number of individual states have begun to use geographic cost indices to adjust the aid paid to local education agencies. There is no common agreement about how best to accomplish this task, and many of the efforts are at best only loosely connected to the research on the topic that we reviewed in chapter 3. We provide sketches below of the various approaches that have been used.

Existing Applications of Inflation Adjustments by the Federal Government

The most widespread inflation index used by the federal government is the CPI-U. The NCES uses this deflator to report expenditures from 1919 to the present (U.S. Department of Education 1996, table 37). Few other federal government statistics are reported over such an extended time period, without extensive change in the underlying statistic. Even the reported Consumer Price Index has changed over this 77-year time period, as statistics for "urban wage earners and clerical workers" were reported through 1977, and for "all urban consumers" since 1978. In addition, the CPI-U is specifically designed to capture the price change in a "market basket" of goods. Whether the CPI-U is adequate as an adjustment for education expenditures has been discussed in chapter 4.

Recently, a President Commission (the Boskin Commission) has asserted that the CPI-U *overstates* inflation by some 1.1 percent a year. If empirically accepted, this would dramati-

cally affect the *Digest of Education Statistics* figures and tables.

The Gross Domestic Product (GDP) deflator has been available since 1959. The Gross Domestic Product implicit price deflator is useful as the denominator in an indicator of public education revenue as a percentage of Gross Domestic Product. It is an attempt to assess the percent of all income in the economy that is being used for education. However, it is important to remember that revenue per student is deflated using the CPI-U. This measure peaked in 1972 for elementary/secondary education, at 4.6 percent (U.S. Department of Education 1995, Indicator 52), and has since hovered around 4.1 percent.

A third measure, used by the federal government to measure the change in the cost of labor (salaries and employee benefits), is the Employment Cost Index (ECI), reported by the Bureau of Labor Statistics (BLS) of the Commerce Department, U.S. Department of Labor. The Employment Cost Index is available from 1975 to the present. Two changes occurred in this index during this period. Prior 1986, jobs were classified from the 1970 Census. From June 1986 through December 1994, jobs were classified according to definitions used in the 1980 Census. Beginning in March 1995, job were classified according to the 1990 Census. In addition, fixed employment weights used to calculate the indices have been reweighted. These weighting schemes followed the use of the various Censuses.

Although little-known, the Employment Cost Index contains a subscale by occupation and industry group of "elementary and secondary schools." These indices, one for compensation, one for benefits, and one composite, are useful not only for assessing change since 1975 in elementary and secondary school salaries and benefits, but also for measuring changes in those items compared with all workers.

Cost Adjustments for the Title I Program

Title I of the Elementary and Secondary Education Act (ESEA) of 1965 is the largest single federal elementary and secondary education grant program to local school districts, about $6.7 billion in fiscal year 1996 (GAO 1996). The purpose of Title I is to provide remedial programs and resources for students in poverty who are poor achievers. These programs and resources are intended to provide additional educational opportunities that may help such students succeed in regular education programs, attain grade-level proficiency, and improve their achievement. State allocations are based, in part, on the state average per pupil expenditure. Within a ceiling and a floor (105 percent and 95 percent, respectively), states that spend more receive a higher Title I allocation. This formula might have originally been designed to reflect a state's geographic cost. From 1988 to 1994, the legislation also required that 10 percent of the appropriations be distributed to local education agencies in counties where children in poverty equaled either at least 6,500 or 15 percent of children aged 5–17. The 1994 reauthorization attempted to improve the "concentration" or "targeting" aspect of the grants, by creating an Education Finance Incentive Program (EFIP). The targeted grants under EFIP weighted students based on the county's or local education agency's child poverty rate and number of poor school-age children. The 1994 reauthorization also included additional dollars by measuring the effort and equity of the recipient state's elementary and secondary education state financing system. The Education Finance Incentive Program basically used a modified coefficient of variation (C.V.) as a measure of equity. The 1994 reauthorization of the Elementary-Secondary Education Act attempted to provide an incentive within Title I to decrease disparity in expenditures across school districts. The EFIP contained a formula that incorporated both a disparity and effort index into the allocation process. Specifically, each

state's allocation is based on its population aged 5–17 multiplied by an effort index derived from per-capita income, and an equity index based on a pupil-weighted coefficient of variation of expenditures per pupil. This pupil-weighting factor may be additionally modified by counting low-income pupils as 1.4 students, and by applying additional similar factors to other special needs children. One of the additional factors mentioned in the legislation is the potential to recognize different geographic costs. Although the 1994 reauthorization included $200 million for the Education Finance Incentive Program, no funding has ever been appropriated for this program.

State Governments

Appendix A sketches individual state uses of cost adjustments, listed alphabetically, which are drawn from the American Education Finance Association's compilation of state aid plans, unless otherwise indicated (Gold, Smith, and Lawton 1995). All of the reports cover the 1993–94 school year. We made follow-up telephone calls to the identified states to clarify points and to collect information about subsequent changes in the methods being used.

New York State incorporated a cost adjustment in 1997–98 to its building aid formula. The building aid cost adjustment was based upon wage and compensation data for construction-trade occupations, using the New York Department of Labor's Occupational Employment Survey. A regional cost factor is applied to the State Building Aid formula for contracts signed on or after July 1, 1998 to assist school districts in regions with high labor costs. The regional cost factor will be multiplied times the maximum cost allowance to arrive at a regionally adjusted maximum cost allowance. State building aid will be paid on the lesser of the actual contract expense or the regionally adjusted maximum cost allowance. The regional cost factor is calculated by dividing the county composite labor rate by the

median state-wide composite labor rate. The county composite labor rate is calculated by adding up the hourly labor rate plus supplemental benefits for carpenters, electricians and plumbers. New York City has a cost index of 1.8191, while Albany has a cost index of 1.0077. In this representation, NYC costs are almost 82 percent higher than Albany's for the hourly rate for building aid employees (New York State Education Department 1999).

We view this adjustment as precisely the type of regional cost adjustment that McMahon recommends to avoid "cost endogeneity." In his view, the existence of such a cost factor, determined by wages and benefits not directly controlled by the school district will not lead to higher building costs in those school districts that receive the additional aid. McMahon would argue that these prices already include factors outside the control of the school district, such as competitive labor market, underlying cost-of-living differences, amenities, and climatic conditions.

Chambers, however, would respond that this methodology does not use hedonic modeling, that is, it cannot incorporate differences in the training, experience and skill levels of those employed, nor the quality of the building. In essence, the school district can choose to hire more experienced and talented artisans to obtain superior quality construction, and attribute that cost to higher salaries. In this way, the school districts can manipulate the costs of building through the wages and benefits carpenters, electricians and plumbers receive through their contracts, and permit the state to provide ever-higher reimbursement. Should the local markets not be competitive, even greater dislocations and diseconomies might occur.

Both McMahon and Chambers are concerned with the same "cost endogeneity" phenomena, and propose different methods and mechanisms to prevent such effects of state aid for-

mulas. This has led Hanushek (1999) to propose combining the approaches, using the hedonic methodology for an entire labor market. For example, if the New York aid approach applied hedonics to control for differences in the training, experience and skill levels of the wages and benefits carpenters, electricians and plumbers obtained, and controlled for the quality of the work performed, it would be independent of school district choices in bargaining, hiring, or aesthetically pleasing construction.

The Use of Geographic Cost Indices to Measure Equity

Much of the research in public elementary and secondary education finance stems from a long battle between property-rich and property-poor school districts to achieve equity in expenditures per student. Various advocates for per pupil expenditure equalization have found plaintiffs in property-poor school districts for whom they could challenge existing state education aid formulas in court. After the 1973 U.S. Supreme Court ruling which held that a rational state public elementary and secondary funding system that produced expenditure inequities was not unconstitutional, advocates for plaintiffs in poor school districts turned to state supreme courts, where the state constitution may set a stricter standard (*San Antonio Independent School District v. Rodriguez*, 411 US 1 [1973]). About one-half of all states have court suits challenging the particular state's education funding formula, and plaintiffs are successful in about one-half of the rulings (Hickrod 1997). There have been various analyses of public school expenditure disparities (see Riddle and White 1994), but, traditionally, pupil need adjustments, rather than cost adjustments have been the primary focus if some modified spending figure other than nominal (actual) per pupil expenditures were used. Parrish,

Matsumoto, and Fowler (1995) were early pioneers in using both student need and cost adjustments (using Chambers' TCI) when examining differences in school district spending. We have reconstituted a portion of a table from *Disparities in School District Spending* by Parrish, Matsumoto, and Fowler (1995), and placed it in table 5-4.

Five equity measures appear in table 5-4. The restricted range is obtained by ordering school districts from high to low per pupil spending, and calculating the difference between the 95th and 5th percentile. The larger the difference, or restricted range, the greater the inequality in school district spending. As can be observed in table 5-4, the restricted range becomes *smaller* when the per pupil expenditures are modified by applying the TCI cost adjustment to them. Thus, cost adjusting the per pupil expenditures suggests that some of the inequality that is usually measured by standard equity measures captures geographic differences in cost. To date, we know of no state court in which this argument has been made to suggest that the nominal (actual) disparities are misleading, and that nominal expenditures should have geographic cost adjustments applied to understand the proportion of the observed disparities that is due to differences in geographic costs. Although the equity measures show less disparity after cost adjustment than before, substantial variation remains.

Table 5-4. —Spending measures of variation

Per pupil expenditures	Restricted range	Federal range ratio	McLoone index	Coefficient of variation	Gini coefficient
Actual	$4,186	1.5	0.850	31.0	0.158
Cost-adjusted	3,373	1.1	0.869	24.6	0.129

SOURCE: Parrish, T. B., Matsumoto, C. S., Fowler, W. J. *Disparities in Public School District Spending, 1989–90.* (1995) Washington, DC, NCES 95–300, p. A-17

Let us return to the example of TCI-adjusted per pupil expenditures that we used in earlier in this chapter (table 5-1) in the Washington, DC metropolitan statistical area. The 13 school districts in the Washington, DC metropolitan statistical area (008840) had an average 1991–92 per pupil expenditure of $6,420, with a standard deviation of $1,473. Dividing the mean by the standard deviation yields the coefficient of variation, which in this case is 4.36. The TCI per pupil spending average of these 13 school districts is $6,146 (or 4.3 percent less than the actual per pupil average), and their cost-adjusted standard deviation is $1,622 (or 10.1 percent greater than the actual standard deviation). The cost adjusted coefficient of variation is 3.79. Here again, in table 5-5, we see that the Chambers' TCI cost adjustment results in a lower coefficient of variation, which is usually interpreted as greater equality between school districts in their spending.

Equity measures are not always affected in this way, however. Peternick, Smerdon, Fowler, and Monk (1998) find that while excluding New York City from an analysis of New York State school districts that were cost adjusted did lead to a lower coefficient of variation (that is, more equity), however, the McLoone index led to just the opposite conclusion. Including New York City, the coefficient of variation was higher (less equity), and but the McLoone was lower. The authors conclude:

> *Measures of equity do not always increase or decrease depending on the adjustment employed. Instead these results indicate one's need to be aware of the basis for the adjustments and the power they hold when considering whether or not to employ them in one's work (p. 167).*

Table 5-5. —Washington metropolitan area per pupil spending, with geographic cost adjustments

School district	TCI cost-adjustment	Per pupil spending in 1991–92 school year	Per pupil spending after cost-adjustment
Falls Church City (VA)	89.5	$8,660	$9,677
District of Columbia	101.7	$8,404	$8,625
Stafford County (VA)	103.3	$4,573	$4,428
Loudoun County (VA)	103.1	$5,791	$5,629
Prince Georges County (MD)	104.5	$5,723	$5,475
Calvert County (MD)	104.9	$5,356	$5,104
Manassas Park City (VA)	107.5	$4,567	$4,249
Prince William County (VA)	106.5	$5,338	$5,014
Manassas City (VA)	108.9	$5,317	$4,882
Montgomery County (MD)	108.1	$7,419	$6,866
Fairfax County (VA)	110.7	$6,368	$5,752
Alexandria City (VA)	108.3	$8,152	$7,524
Arlington County (VA)	110.6	$7,788	$7,044
Mean		$6,420	$6,146
Coefficient of variation		4.36	3.79

SOURCE: Author's illustration using cost indices from Fowler, William J. Jr., and Chambers, Jay. 1995. *Public School Teacher Cost Differences Across the United States*. Washington, DC: U.S. Department of Education, National Center for Education Statistics. NCES 95–758.

Summary of Applying Geographic and Inflation Deflators

Our exploration of the application of geographic and inflation cost adjustments has been quite sobering. Examining geographic cost adjustments, we find that the approaches used by two proponents of cost adjustments result in differing conclusions about whether a particular school district's costs are 13 percent higher than the nation's average, or 12 percent lower than the nation's average. Nor is replication of a single advocates' approach comforting, as small changes in Chambers' hedonic approach leads us to similarly large differences in measuring the hedonic geographic cost ad-

justment for Chicago, or Philadelphia, or Detroit in 1991–92 and 1993–94.

As we have also demonstrated, equity measures that employ these geographic cost adjustments will also be greatly affected by the accuracy of the geographic cost adjustment and the particular technique employed to obtain the cost adjustment. While it is generally desirable to apply geographic cost adjustments to better understand the underlying differences in expenditures not due to differences between location, great care must be exercised in being precise about the difference between two school districts.

It may be precisely this concern that has led the federal government and states to apply geographic "cost-adjustments" that employ far less sophisticated adjustments that may be less accurate, but far more stable. Of course, if the school district or state can manipulate the components of the index to its advantage, then McMahon's concern with "cost endogeneity" may be well taken.

Chapter 6. Lessons to Learn and Directions for Future Work

We use this final chapter to note lessons that can be learned from the available research and to offer advice for future explorations and applications in this very important area of public policy. We deal with the geographic and longitudinal indices, in turn.

Geographical Cost Adjustments

It is clear that it costs more to provide comparable educational services in some places compared with others. It is also clear that having a good index of these cost variations would provide important benefits to policymakers with responsibilities for achieving equity as well as efficiency in the distribution and use of education resources. Finally, it is clear that while substantial progress has been made in resolving conceptual as well as estimation problems, much work remains to be done. As researchers and policymakers look to the future, we are confident that the future models will become more sophisticated. We also believe ef-

forts need to be made to educate the public about the nature of cost adjustments in education. It would be a mistake to make progress toward constructing more sophisticated cost models without a parallel effort to educate the public. There is an important political dynamic associated with cost adjustments in education, and this needs to be faced squarely. We devote this section to a review of the challenges and include some advice about how to deal with political realities that will surround most attempts to incorporate an index of cross-sectional differences in cost into public policy.

The Generalizeability of the Index

Recall that most of the available indices are focused on one type of cross-sectional cost difference that can exist in education. In particular, most of the attention has been focused on differences in the unit price of teachers, and it follows that policymakers need to make judgments about how appropriate it is to generalize from differences in the cost of a single input to overall differences in the cost of producing learning outcomes. As a matter of principle, the more comprehensive the index, the better, and in this regard the Chambers GCEI is superior to the remaining input-oriented indices. While the production function-based approach is, in theory, even more appropriate since it gets to the bottom-line question of what it costs to produce gains in learning, this approach is the least well developed of all that we considered and is only available within certain individual states.

The Distinction between Controllable and Non-Controllable Influences

We have indicated previously that costs are measures of minimum resources required to achieve some outcome or result. We have also stressed the importance of removing voluntarily elected expenditures from cost considerations.

Analysts disagree about how best to remove these controllable influences on spending, and policymakers must make a judgment about their level of comfort with the several options that are available. Recall, that Chambers' work with the hedonic index is relatively ambitious and involves drawing distinctions between influences on the cost of teachers that are within and outside of the control of local school officials. Chambers is explicit about how he drew these distinctions, and policymakers must judge for themselves their level of comfort with the approach.

The Level of Aggregation

Teacher price indices can be constructed at any number of different levels of aggregation. The largest unit typically conceived is the state as a whole rather than regional groupings of states, due largely to the difficulties associated with characterizing differences in the regulatory environment that exists across state boundaries. One of the drawbacks to indices that cover large geographic regions is that they can conceal internal variability. Nelson (1991) notes, for example, that the cost of living alone can vary as much within a state as between states. He cites the differences between the estimate he uses for the cost of living in the Buffalo metropolitan area (100.5) and New York City (150.9) and notes that this discrepancy is larger than the difference between New York State and any other state in the nation.

As Barro put it:

> *There is likely to be more variation in amenities within than among states. The same state may contain both highly attractive suburbs and decaying, crime-ridden central cities—school systems where teachers eagerly seek work and systems where they work only as a last resort. Indicators of state-average amenities may prove misleading. If, for example, the central-city districts in a state were reducing staffs in response to declining enrollment while the suburban districts were doing most of the teacher hiring, an analysis of*

the state average teacher salary in relation to the statewide average level of amenities would yield incorrect results. (Barro 1994, 41)

However, more narrowly drawn regions present their own difficulties. Suppose we were to define cost indices at the individual school district level. Also, suppose we found that the costs in one district were quite a bit higher than the costs in a neighboring district. Teachers may or may not reside in the districts in which they teach. Indeed, in terms of making a decision about whether or not to accept employment in a particular district, the teacher is more reasonably concerned with cost of living in the region rather than the neighborhoods located within the prospective employing district.

The Potential for Double Counting

We have already noted in chapter 2 that adjustments for cross-sectional costs may already be present within existing aid distribution mechanisms even if they are not explicitly labeled as cost adjustments. However, policymakers cannot simply assume that these adjustments are present and that their magnitudes are correct simply because they may have entered the system implicitly. In other words, there may be serious equity and productivity problems associated with a decision to do nothing and in effect assume that it is best to work with nominal dollars magnitudes that are not adjusted for cross-sectional differences in cost. A judgment needs to be made about the degree to which cost considerations may have entered previously made decisions about weights and other features of aid distribution systems. The most prudent path for a policymaker to follow would involve making efforts to estimate differences in cost coupled with the use of simulation exercises that would show the impact of alternative cost-oriented adjustments that might be added to existing formula. In cases where cost differences have been implicitly introduced using presum-

ably crude weighting adjustments, real progress ought to be possible by looking separately at cost differences and dealing directly with whatever differences might be revealed using sophisticated cost models.

Political Considerations

Finally, there are some stark political realities that surround debates over the construction and utilization of cross-sectional cost indices. This is true whether the index is designed to make adjustments across states or across districts within individual states. To the degree that the index is used to adjust the flows of school aid (either to states or local education agencies), the contentious politics of redistribution need to be considered. These political difficulties become all the more divisive if the index is applied to the distribution of a fixed pool of resources. In other words, if the size of the pool is rising at the same time that a cost-related adjustment is applied, individual sites will lose ground in a relative sense, but to some degree they can be held harmless from absolute drops in the resources they receive.

The divisiveness of the politics surrounding geographical cost index adjustments is particularly pronounced because as a general rule input price differentials accentuate already existing political cleavages. Consider the case of individual states like Missouri or New York. Both of these states have made efforts to construct teacher price indices and have not succeeded at having the results adopted by the respective state legislatures. Why? Some of the explantation is related to the fact that the proposed indices worked to the advantage of one well defined political interest group (urban and suburban areas) and to the disadvantage of second political interest group (rural areas). In New York this division connects to party affiliation with upstate Republi-

cans seeing very little merit in the cost index proposal in contrast to the positive views of downstate Democrats.

One of the perplexing parts of the debate over geographically based cost indices is that a political standoff between urban, suburban, and rural interests, to some degree, can be averted if there is a willingness to broaden the notion of cost. Recall the input, service, and outcome hierarchy that we introduced in chapter 2. Recall also that the school district enables the delivery system to operate, and that the school district organization has a dramatic impact upon costs. These costs arise in part because of scale economies and diseconomies (that is, the size of the district and its schools). As a general rule, small and rural districts can be expected to face higher costs due to scale-related differences. We have already suggested that these districts tend to enjoy relatively low teacher input prices, according to the available estimates. Thus, the two types of cost work to offset one another. It follows that a preoccupation with one type of cost to the exclusion of the other, will work unfairly to the disadvantage of a key political unit. A broadened approach to making adjustments for geographically based differences in cost such that both individual ingredients (teachers) price differences and scale-related differences (school district size) are dealt with in the same legislative proposal can serve to enhance the political appeal of the proposal. Texas has been pursuing a variant of this broadened approach, and, in contrast to places like New York where the focus has been on only the individual ingredients (teachers) price differences, has succeeded in implementing a cost adjustment within its program of state aid for education (Monk and Walker 1991).

There is one further point that needs to be made about the political viability of cost adjustments. It is abundantly clear that these adjustments are more complicated than is commonly supposed, and serious analysts quickly find them-

selves working with complex models and sophisticated econometric tools. There is a degree of suspicion and distrust that surrounds complex statistical analysis, and experts' assurances that various things have been controlled for statistically can ring hollow, particularly when the results have the potential to shift the distribution of large sums of resources. In this light, it is not surprising to find remarkably crude adjustments in place. The federal government's current practice of adjusting Title I funds on the basis of nominal differences in per pupil spending in different states (subject to certain caps) is a good case in point. No statistical regression model needs to be estimated for these adjustments to be made. The thinking seems to be that some adjustment is appropriate given the wide differences in spending across regions in the country coupled with the underlying belief that some, but not all, of this is due to differences in the cost of providing comparable educational services. There are very real limits to what the traffic will bear in terms of more sophisticated adjustments and policymakers need to keep this point in mind as they contemplate moving forward with adjustments of the type we have reviewed in this chapter. Further, once any given practice is in place, legislators are often loath to tinker with the accepted adjustment, as the new formulation will require forming a new consensus.

Longitudinal Cost Indices

Chambers (1997) compared several of these inflation measures for the six years from 1988 to 1994, which coincided with three administrations of the national Center for Education Statistics (NCES) Schools and Staffing Survey (SASS). This permitted him to compare the inflation measures with the changes in teachers' salaries, holding constant such attributes as degree status and experience. Remarkably, the CPI, GDP, and ICEI results are very similar for this short

period. Only the NSI and SPI have markedly different inflation rates. The Employment Cost Index falls in between the CPI, GDP, ICEI, and the NSI and SPI. This was quite unexpected, and suggests that a general consensus is possible about the rate of education inflation.

Nevertheless, considerable work remains to be done on these inflation indices. We need to understand why there are differences between the price adjustments, beyond different methodologies. As Chambers acknowledges, the GDPD measures price differences for all consumer and investment goods and services in the Nation's domestic economy. The CPI captures price differences for consumer goods and services. The CEI and the ICEI intend to capture price differences in elementary and secondary education personnel. That they are in such agreement in Chambers' work is encouraging, but even Chambers noted that the measures diverged in the latter 3-year time period he studied. Again, the reasons are not known, but should be.

Potential future improvements in the ICEI include obtaining more information about fringe benefits, and the role of noncertified personnel. Since SASS administrations are at least five years apart, some study of the use of a surrogate measure, such as the CEI, are in order.

Advice for Next Steps

In light of all of the foregoing, we have a number of guiding principles for policymakers to consider as they seek to take advantage of what has been learned about variations, both cross-sectional and longitudinal, in the costs of education.

Cost Adjustment Guiding Principles

1. Keep the indices as simple and understandable as possible.

2. Strive to reach consensus about how ambitious you wish to be with respect to cost adjustments in full knowledge of the flaws that remain in the available tools.

3. Keep in mind that not all adjustments are beneficial to all parties. Be particularly wary of flawed adjustments that benefit one set of political interests over others.

4. Provide for gradual phase-ins. Consider "quasi-leveling up" strategies and take advantage of inflation: e.g., you can level up and achieve a reallocation as long as you have the units that need to grow at a rate that is higher than the units who need to shrink. This takes more time, but patience is sometimes warranted.

5. Place primary emphasis on supporting the further improvement of the available indices.

CONCLUSIONS

Our first conclusion is that the education research community has not paid sufficient attention to both geographic and inflationary differences in the costs of education. In most cases, geographic cost adjustments have not been applied when assessing, for example, intra-state fiscal equity. The courts, plaintiffs, and defendants have all used nominal (actual) per pupil current expenditures in their arguments. However, there is ample evidence that geographic cost differences are something those contemplating per-pupil expenditure equity should remove from their considerations. Generally, the use of geographic cost adjustments reduces most measures of disparity. Although the equity measures show less disparity after cost-adjustment than before, substantial variations remain. However, for those school districts that are acquiring higher-quality staff, or

greater numbers of staff (reducing pupil/teacher ratios), the correction of their nominal expenditures will cause their expenditures to be even greater than before (see chapter 2). The most common use of geographic cost adjustments has been to give school districts in high cost-of-living areas higher state aid. However, this common usage should be reconsidered, since such aid may be disequalizing, that is, it may aid wealthy school districts to the detriment of the poor. In addition, it is not, we would argue, the cost of living for which we wish to compensate these school districts. Rather, we would wish school districts be compensated for the acquisition and retention of comparable staff, wherever they reside. This is why we feel more conceptually comfortable with the hedonic rather than the market basket approach. Some school districts in tony locations with a cachet and superb facilities and a student body with panache may acquire and retain very talented teachers for much less than their less fortunate neighbors, who can only attract such a staff by paying a large premium. To date, educational researchers have not emphasized these differences, in part because a suitable methodology for estimating these effects has been unavailable. The good news is that indices of this kind are becoming available. The not so good news is that the available indices remain flawed because they fail to distinguish perfectly between expenditures and bonafide costs and may introduce perverse incentive effects that could increase spending on education with little resulting gain.

Our second conclusion is that existing cost adjustments are frail reeds, indeed. Despite his precision and intricate methodologies, Chambers arrives at very different geographic cost adjustments for 1990–91 and 1993–94 for Chicago, Philadelphia, and Detroit. These differences pale in comparison to differences between researchers and methodologies. What would be desirable would be an emerging consensus about the appropriateness of a given technique, and general unanimity regarding its application, at least in ad-

justing nominal (actual) revenues or expenditures. Instead, we see researchers still vociferously debating the merits of their own work, and the defects of the approaches of their similarly situated brethren. Until the academic community agrees in the robustness of any cost adjustment, the future use of any adjustment seems unsustainable. If the cost adjustments are not viewed as hardy, commonplace and utilitarian tools, then there will no longer continue to be an investment on the part of the research community to attain them.

We were also unprepared for the sobering discovery that these worthwhile and desirable adjustments would provoke such rancor. The simple use of one geographic cost adjustment versus another was sufficient for one researcher to suggest that state-aid systems that employ such an adjustment "...encourages inefficiency and invites disaster (McMahon 1996, 95)." Another highly regarded economist interprets an analysis of measurement issues by Mishel and Rothstein on how to include the effects of inflation in measuring school spending as "...while not their interpretation, ...their analysis provides perhaps the most persuasive case for a productivity collapse [in education] (Hanushek 1997, 185)." We suspect the reader will join us in urging all participants to understand that we are all engaged in a search for mechanisms that will permit us to report school spending more accurately, and that we admonish all involved to suspend critical judgement about the implications of attempted advances in this endeavor until each advocate has had ample opportunity to rethink the mechanism he proposes.

Our third and final conclusion is that more effort needs to be devoted toward building consensus in the methodologies that can be used as geographic cost adjustments and as deflators. There is a great need in the education finance research community for these mechanisms in order to bet-

ter understand education spending in real terms. We even would go so far as to suggest that it is improper to analyze education spending without correction for differences in geographic costs, or differences in costs over time without correction for the effects of inflation. However, we also find it improper to analyze "adjusted" figures where details surrounding the nature of the adjustments are inaccessible to the consumer. Situations like these cry out for the use of sensitivity analyses so that analysts, policy makers, consumers, and taxpayers alike can have an understanding of how sensitive the results of the analyses are to the use of one rather than another of the possible cost adjustment techniques.

Appendix to Chapter 5. Descriptions of Existing State Cost Adjustments

Alaska

Alaska makes use of two conceptually distinct types of cost adjustments in its state aid system. One adjustment is based on a cost-of-living index. One such index is defined for each of the 54 school districts in the state. In addition, Alaska makes use of an adjustment for "instructional units" that reflects differences in scale economies that can be realized in districts of different sizes. Thus, the Alaska system includes adjustments for both differences in the cost of inputs and differences in the cost of combining inputs into educational services.

Colorado

Colorado has established a formula that explicitly introduces a "cost-of-living" factor. This adjustment reflects differences in the costs of housing, goods, and services among different regions of the State. It is constructed by the Legislative Council and is expected to be re-calculated every two years. The factor is applied to that portion of the base that deals with personnel costs. The cost-of-living adjustment is focused on differences in the costs of inputs that enter the Colorado system.

The Colorado formula also introduces a "personnel cost factor" that is designed to capture the effects of economies of scale. The personnel cost factor is designed to recognize scale related differences in the costs of producing educational services.

Florida

The state of Florida is well known for its long standing use of a market basket based cost-of-living index to make adjustments in its state aid distributions. The index is known as the Florida Price Level Index and is constructed by the executive office of the Governor. The index is constructed annually and is introduced into the funding formula using a moving three-year average. In 1993 the Florida Legislature structured the index so that it ranged from a low of 1.000 to a high of 1.2279. Thus, no district receives less aid in an absolute sense because of the adjustment. Florida's index is focused entirely on differences in the cost of inputs.

Massachusetts

Massachusetts uses what it calls a "wage adjustment" factor that generates an index for each of 25 regions of the state. The factor is updated annually and for 1998 aid, it ranged between a low of .834 and a high of 1.073. Thus, in contrast to what we saw for Florida, districts can receive aid allocations that are smaller in absolute amount thanks to the cost adjustment. There is a further provision which stipulates that no district with a high incidence of poverty can be assigned a cost index smaller than 1.0. The Massachusetts index is designed to offset geographically based differences in the costs of inputs entering the system.

Ohio

McMahon (1996, 95) notes that Ohio uses a Cost of Government Services (COG) type of index to adjust for differences in the cost of education in its funding formula. This is an adjustment that is based on prevailing wage differences in the public sector. One of the concerns expressed by McMahon is that the approach used by Ohio places unwarranted emphasis on salary differences for workers with relatively low levels of skills. School districts, in contrast to many areas of the public sector, rely relatively heavily on highly skilled labor.

The Ohio index is known as the "cost of doing business" factor and is entered explicitly into the calculation of the basic aid program provided by the state. It is an input-oriented adjustment that is calculated by the Ohio Department of Education and is based on wage data provided for all workers in the state provided by the Ohio Bureau of Employment Services. It is based on the average weekly wages for the county in which each district is located plus its contiguous counties. The current range is between 1.00 and 1.089, and is similar to the Florida adjustment in the sense that it gives rise to no absolute reductions in aid.

Texas

Texas provides for cost adjustments that are rooted in both input price differences and scale economy differences. The state has made use of a hedonic type of index in which an effort is made to distinguish between controllable and uncontrollable influences on teacher salaries. The state is divided into a variety of categories that include region, size, area, density, educational characteristics, and economic conditions. Adjustments have also been made for fast enrollment growth and other factors that have bearing on needs for facilities. The Texas approach is noteworthy because there have been explicit efforts to incorporate input prices as well as service cost differentials into a comprehensive treatment of cost.

Virginia

Virginia provides for adjustments that affect nine districts in the state, seven county districts and two city districts. These districts are located in the northern area of the state, near Washington, DC. The goal of the program is to recognize the high cost of living for the Washington, DC metropolitan area relative to elsewhere in the state and takes the form of input-oriented cost adjustment.

Miscellaneous

It is worth noting that District Percentage Equalizing state aid plans include elements of a crude input cost differential to the extent that they are driven by expenditures. These aid plans have a "spend to get" feature since they provide state matches for revenues raised at the local level. If costs are higher in a particular district, expenditures will tend to be higher, and all else equal, the state will find itself providing higher levels of support than would otherwise be the case. We say the adjustment is "crude" because if it is simply tied to expenditures, there is no provision for isolating uncontrollable costs. Recall that the distinction between costs and expenditures is very important and that sophisticated cost indices include efforts to single out costs for adjustment.

States operating programs with percentage equalizing elements include: Rhode Island, Connecticut, New York, and Pennsylvania. However, these plans typically operate with numerous restrictions and special rules that typically limit the degree to which they function as expense-driven aid systems.

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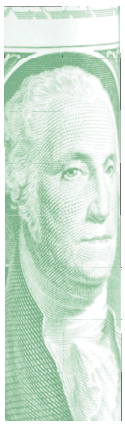

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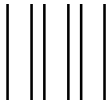

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