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.

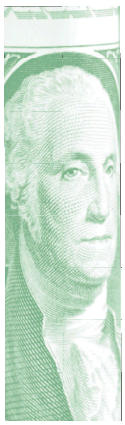
Cost of Education Index across geographic locations. Chambers (1998) more recently built upon the earlier TCI work by broadening the index to include other types of inputs (school administrators, noncertified school personnel, and nonpersonnel inputs). The new index, known as Cost of Education Index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

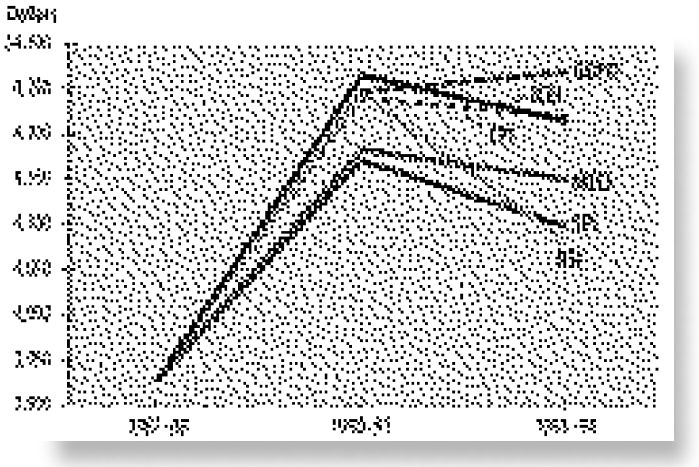
Cost Index does not control for the discretionary factors affecting school district costs, nor does it control for the personnel equivalent of "item substitution."

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.