Adjusting for Differences in the Costs of Educational Inputs

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Various important policy decisions, fund allocations, and contractual provisions rely on the calculation of price differences, implying that the estimation and use of different price adjustment mechanisms have serious repercussions. Accordingly, controversies about the best way to proceed also exist. A simple but powerful example is the recent debates about the accuracy of the Consumer Price Index (CPI). There are not only technical disagreements but also political disputes owing to the important uses of the CPI in both public programs and private contracts.

The discussions about price adjustments in education, while mirroring the technical complexity, have not received the same public attention as the CPI debate, because their implications are considerably less. Nonetheless, the general issues have been widely discussed within the education sector. That discussion has been furthered by recent analyses by Chambers (1997) and by Mishel and Rothstein (1997).

Each of those analyses provides a combination of broad interpretation of the issues and of specific recommendations about how to proceed in the development of data series. At the same time, they emphasize different issues and make conflicting recommendations. This paper, which extends Hanushek (1997b), clarifies the points of disagreement and provides conclusions about how to proceed with price adjustments to education spending data.

Overview and Background

The necessity of making some adjustment for overall inflation levels in the economy is well understood. The federal government routinely produces a variety of price indices or deflators that can be used to compare nominal spending at different times. A similar set of indices can be used to compare prices and spending in different geographical areas at the same point in time.

Different deflators also exist for various commodities. It is common to see reports of how, for example, energy prices have increased more rapidly than those for food. Official price series exist for a wide range of different items.

Thus, the suggestion that price movements in education may not be the same as price movements elsewhere in the economy does not

seem very surprising. Furthermore, it would seem natural to develop data that would permit estimation of how prices in education move relative to those elsewhere.

Perhaps the most important use of any price index for education, as emphasized by Mishel and Rothstein (1997), is to be a building block in assessing any changes in productivity in the education sector. For example, an enormous amount of attention has been given to "reforming" education, a concept rooted in the notion that better performance is possible, given the resources devoted to schools. Many alternative proposals have been made for this concept, and the organization and delivery of education has undergone considerable evolution. Total spending on schools has also risen dramatically (Hanushek and Rivkin 1997), so it would be useful to ascertain whether these changes have had the desired impact. A problem, however, is that one might have expected total spending to rise over time with general inflation. In such a case, it would be inappropriate to attribute the inflationary increases to reforms and inappropriate to gauge any changes in productivity by just the nominal increases in spending. A compatible price index could be employed to eliminate any general price increases so that attention would be focused on the specific reforms and their results.

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In general, knowing the overall pattern of cost increases permits individual districts, individual states, and the nation to judge whether real resources for schools are increasing or decreasing and to make comparative statements about the rate of increase in specific areas versus the nation as a whole. In other words, this information provides a way of judging the pattern of resource investments into schools.

A second use of price adjustments involves making cross-sectional comparisons of spending. Largely driven by equity concerns, interest in variations of expenditure across geographical areas has remained high for the past 25 years. While some consideration has been given to interstate variations in spending, the limited role of the federal government in funding schools and the lack of any federal court activity have combined to focus most attention on intrastate variations.[1] Because of special conditions in a given local area, the same set of school inputs may have differing costs. If this is the case, it is obviously difficult to compare spending across states or districts without correcting for differing purchasing powers.

The necessity of making adjustments for price differences is not controversial. The real issue is how these adjustments should be made. A number of alternative indices of price differences are currently available and regularly produced by the federal government. A wider range of possible indices have been proposed, and some of these focus on specific aspects of the education industry. In part because of the arcane nature of some of these discussions, confusion about both the issues and the best approach remain.

This paper aims at clarifying the issues in adjusting education data for price differences. In the course of this discussion, direct analysis of the recent papers by Chambers (1997) and by Mishel and Rothstein (1997) is provided.

Basics of Price Indices

Much of the discussion of price indices refers to aggregate data for the entire economy. The CPI and Gross Domestic Product (GDP) price deflator are well known aggregate price

[1] The U.S. Supreme Court effectively eliminated federal court involvement in school funding equity cases in its 1974 ruling in *Rodriguez v. San Antonio Board of Education.* The federal appropriations for schools have concentrated on compensatory education for disadvantaged students. In that determination, overall price variations that affect calculations of poverty rates are relevant, but variations in school spending have not been central to the funding, so education price indices would not play much of a role.

indices. These indices are designed to indicate how overall prices, or inflation, affect the ability to buy a market basket of consumer goods or of final output in the economy. The construction of such price indices is, however, affected by a number of difficult conceptual and data issues. The precise approach should also be related to the potential use of the index.

The idea behind price indices is that they should provide an indication of how much more it costs today than yesterday to purchase the same amount of a given commodity.[2] For example, if one considers standard wood-graphite pencils, one needs only compare the price per unit at two different times to develop an appropriate deflator; i.e., one would divide today's price by yesterday's price to determine how much prices had increased, and that would be our deflator, which could be used to put any purchase of pencils on common footing. In this example, the calculations are straightforward, and there would be no controversy.

Where do the complications arise? First, consider a price index for "writing instruments." If, in addition to wood-graphite pencils, there are also disposable ballpoint pens, the price index must consider the increases in both. It is natural to think of calculating a weighted average of the price increases in the two different commodities to arrive at the best price index, where the natural weights would be the purchases of the two. In this instance, there is also no difficulty or controversy as long as the same relative amount of the two commodities is purchased over time. But, if the purchases of, for example, pens rises over time relative to the purchases of pencils, a different price index will be calculated depending on whether initial purchases, ending purchases, or an average of the two are used to weight the observed price changes. This issue, which is discussed in Chambers (1997), is a classic one in the discussion of index numbers, and the implications of different choices are well understood. Specifically, because people might be expected to buy somewhat more of the writing instrument whose price is falling in relative terms, one would expect the relative purchases to change over time and in ways that lead directly to biases in the true increase in the prices of "writing instruments." There are practical difficulties in dealing with these problems, but the underlying concepts are clear.[3]

Second, commodities change over time. For example, writing instruments have evolved such that there are mechanical plastic-graphite pencils, roller-ball pens, and felt-tipped pens. As new products are introduced and as old products are improved, it is less clear how to compare prices of writing instruments over time. For example, a plastic-graphite mechanical pencil today costs more than a wood-graphite pencil did yesterday, but part of the increase in cost reflects quality improvements in pencils and part reflects simple price increases. These quality changes are very important in some commodities (e.g., computers), and correction for potential biases here requires sophisticated analysis. With sufficient information, for example, it is sometimes possible to disentangle price and quality changes through statistical means, such as estimation of hedonic price equations that indicate how various, more fundamental characteristics influence a commodity's price. (As discussed below, this approach is one proposed attack on developing price indices for education). At the same time, state-of-the-art analysis is expensive and difficult and frequently does not resolve all questions.[4]

The idea behind price indices is that they should provide an indication of how much more it costs today than yesterday to purchase the same amount of a given commodity.

[2] This discussion is framed in terms of changes over time. The fundamental concepts, however, apply equally to purchasing commodities at two different geographical locations. Differences between intertemporal and cross-sectional indices are discussed in subsequent sections.

[3] The "substitution bias" of fixed weight indices is one of the elements of the debates over the accuracy of the CPI.

[4] The treatment of quality changes is one of the most contentious areas in the discussion of possible revisions in the CPI. The best approaches to adjustments for quality change require large amounts of data and are infeasible for all of the detailed commodities that enter into to the CPI. Thus, considerable judgment is needed to decide how to approach this area.

Third, special problems arise when there are not effective competitive markets operating. The advantage of having commodities traded in competitive markets is that it is reasonable to presume that competition pushes prices toward the minimum feasible prices (which are generally the marginal costs of producing the commodities). With competition, the increase in observed purchase prices of the basic commodities provides the raw data for calculating price indices. Concerns about purchase prices are, however, particularly relevant for governmental purchases. For example, consider purchases of common claw hammers by the military. In the first period, the military may simply go to a hardware store and purchase its annual supplies at $20 per hammer. In the second, it may accept contractual bids in which, among other things, a variety of specifications for the precise character of the hammer are written into the bidding process—leading it to pay $700 per hammer in the second period. Is it reasonable to conclude that the price of hammers has increased by a factor of 35? Although a spending increase by a factor of 35:1 was observed, that may differ significantly from what has happened to the price of hammers. Some portion of the increase in actual expenditure per hammer may reflect quality differences, some portion might reflect the costs of doing business through the government's bidding process, and some portion might reflect excessive payments that exceed the minimum possible price in competitive markets. While the solution might differ by purpose of any analysis, one would typically accept the price increases in competitive markets for the same commodity as the correct data for calculating a price index. If there are no competitive markets for similar commodities, the appropriate approach requires generally very difficult analysis of the specific circumstances.

[I]t is difficult to define quality in a way that allows distinguishing over time among price changes, quantity changes, and quality changes.

Fourth, special problems arise when considering services as opposed to goods in the economy. With goods in the economy, such as writing instruments, one can generally define the commodity that is being purchased and calculate unit prices for each individual element such as pens and pencils.

With services, it is more difficult. Consider, for example, analytical writings about education price indices. It is difficult to define precisely what the commodity is. The pages can be counted. They can be corrected for margins and font sizes. But it is difficult to define quality in a way that allows distinguishing over time among price changes, quantity changes, and quality changes. These problems have been long recognized, historically in terms of governmental services and more recently, with the rise of a variety of services in the private economy, in terms of the general service sector.

These separate issues have received attention in a variety of contexts. More important, each enters into the calculation of price indices for the education sector. The combination of all of the issues suggests that the problem of developing reliable price indices for education is likely to be very difficult. Before discussing the specific application of education price indices, it is useful, to consider issues of productivity and how they relate to price indices. Because, as described above, the measurement of productivity is a prime motivation behind the development of price indices, the discussion is more focused if put within that context.

Inputs, Outputs, and Productivity Growth

Productivity involves the relationship between inputs and outputs. Specifically, productivity is thought of as a change over time. If it takes fewer inputs to create a given level of output, one says that there has been productivity growth. If one observed real inputs and outputs, one could easily calculate productivity change. Unfortunately, it is not that simple, and the complications are the impetus for much of the consideration of price indices in education.

The previous discussion has made no distinctions between inputs to or outputs of production in the economy. While there are practical distinctions in their measurement (which will be discussed later), the basic concepts and issues considered above apply equally to price indices for inputs or outputs. A consideration of both input and output price indices does, nonetheless, pinpoint the key issues surrounding productivity. This consideration will also permit investigation of underlying conceptual issues about productivity growth in education and other service industries.

We often observe just total expenditure and not the quantities of inputs and outputs. Total expenditure is price multiplied by quantity of the good or service being considered. In order to consider productivity changes, it is necessary to consider how prices change, since total expenditure can increase because of an increase in real quantities or in prices. Price indices or price deflators are used to separate price changes from real changes.

Improvements in productivity imply that fewer inputs are required for producing one unit of the output (assuming that the quality of the good does not change). Over time, if we can accurately calculate the real value (i.e., inflation-adjusted value) of outputs and the real cost of inputs, growth in productively is directly related to how fast the real value of output grows relative to how fast the real cost of inputs grows. If the value of output grows at the same rate as the costs of inputs, productivity is constant. If the real value of output grows faster than the real costs of inputs, productivity is improving, and the growth in productivity can be calculated simply as the difference in these two growth rates. The opposite case, however, has proved more relevant for education, because the data have shown that real expenditure appears to be rising with no perceptible improvements in outputs—suggesting productivity declines.

The real growth in either output or inputs is typically calculated by deflating nominal total expenditures by an appropriate price index. For any given growth rate in nominal spending on inputs, a higher estimate of the growth in input prices implies that there is lower growth in real inputs. For any given growth in value of a unit of output, lower growth in real inputs implies a higher growth rate for productivity. This consideration provides a way of interpreting some of the more politically motivated discussions of educational price indices. If it is possible to show that the price of inputs has risen faster than the standard employed deflator for input prices suggests, the growth in productively would be larger than commonly estimated. In education, however, the discussion has more typically been one of falling productivity. Thus, more rapid increases in input prices (which imply that real inputs have risen less rapidly than thought) would imply that the productivity fall is less than people believe based on standard calculations.

A simple example will help clarify the ideas. If spending per pupil increased by 8 percent and the general price level went up by 5 percent, we would calculate the real cost of inputs to have risen by 3 percent. If educational output were flat during the time, it is natural to say that productivity fell by 3 percent, because we need 3 percent more real inputs to produce the same output. If, however, input prices went up faster than calculated by the general price deflator, say 6 percent instead of 5 percent, it is natural to recalculate the decline in productivity to be 2 percent.

While the calculation of productivity change motivates the discussion of ensuring the use of appropriate price deflators, it neither explains why patterns of productivity change occur nor provides direct guidance on the choice of possible price deflators. Whenever talking about productivity, particularly in education and service sectors, some attention is typically given to arguments by Baumol

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(1967) about the likely course of prices. Specifically, if service sectors are ones where productivity growth is necessarily low—say, for technological reasons—they will face cost pressures in the hiring of inputs. If there are other sectors in the economy which have more rapid improvements in productivity, they can afford to pay more for labor and other inputs. This will put the service sector with its low productivity change at a disadvantage, because everybody must pay the same price for labor in a competitive market but the service sector's output prices must increase more rapidly than those in the sector with productivity growth.

These arguments, explained in more detail in Hanushek (1997b), are irrelevant to the actual calculation of price indices. They merely provide a hypothesis about the kinds of changes in prices that might be seen over time.

[S]imply looking at the increase in total spending per student will not indicate what has happened to the value of a standard, quality-equivalent level of output.

The situation is more complicated if there are quality changes in outputs. The measure of value of output should be adjusted for any differences in quality per unit of output. To see why this is the case, consider education. If more inputs were applied to schools in order to improve the quality of student achievement (say, the level of mathematics or science proficiency), simply looking at the increase in total spending per student will not indicate what has happened to the value of a standard, quality-equivalent level of output.

The fortuitous advantage for calculating the data on price increases and productivity in the education sector is that quality appears flat in education over the past quarter century. While specific measures show some rises and falls for specific years, comparisons of the National Assessment of Educational Progress (NAEP) for reading, science, and mathematics show the 1970 levels and 1996 levels very close (Hanushek 1997b). If quality has not changed, it is possible to estimate the growth in productivity by subtracting the growth in spending per pupil from the growth in input costs per pupil. As Hanushek (1997b) shows, spending has risen considerably more rapidly than input costs, whether input costs are measured by the growth in CPI, GDP deflator, or wages of college graduates. Thus, productivity growth would be estimated as negative—i.e., productivity has fallen.

Arguments about the course of productivity change are, nonetheless, irrelevant to the consideration of how to develop indices of input prices or output prices. Thus, the specific recent proposals should be studied.

Net Services Index

Mishel and Rothstein (1997), expanding on the previous work of Rothstein and Miles (1995), have proposed deflating education expenditure by a price index that measures increases for a select part of services. This index, the Net Services Index or NSI, modifies the service component of the CPI by eliminating components for housing and medical care. The design apparently attempts to compare education prices with those in other sectors expected to have similar patterns of inputs to that of education.

As mentioned earlier, the measurement of price indices in the general service sector is particularly difficult, because it is difficult to hold quality constant. (Measurement of quality in the education sector, in contrast, is made relatively easy by the frequent testing of students.) Therefore, the Net Service Index (NSI), which is based on a composite measurement of output cost increases across different service sectors, will be subject to considerable uncertainty (or measurement error).

The price index per unit of output in the selected services represents the increase in input prices per unit of output minus the increase in productivity of the service sector. If the inputs used in these service industries are similar to those in education—which is apparently an underlying assumption behind the NSI—then differences in price increases in education and the NSI simply reflect differences in

productivity growth. Rothstein and Miles (1995) and Mishel and Rothstein (1997) tend to interpret the NSI as an input deflator, which it is not. It does, however, provide a useful tool for comparing education to the prototypical example of a slow growing sector—the service industries. For this reason, Hanushek (1997b) points out that Mishel and Rothstein have inadvertently identified and provided strong evidence for the productivity collapse in the education sector.

Hedonic Price Indices

Chambers (1997) provides an alternative approach. He estimates hedonic wage indices for teachers and uses these to adjust prices for differing labor market attributes. This approach mirrors the methods often used to adjust for quality changes in a variety of products.

The basic approach is to use regression techniques to decompose teacher salaries into underlying characteristics that enter into salary determination. The idea is that a series of fundamental factors enter into the determination of salaries. Using variations in these factors across areas, it is possible to infer what each contributes to the salary that goes to an individual. Moreover, if this is a stable function over time, it is possible to distinguish between "quality" changes and "price" changes.

Consider the analogy of the price of computers. If one were to regress the price of a computer on the processor speed, the memory size, the hard disk size and speed, and other relevant attributes, one could estimate how each of the characteristics of the computer contributed to its price. Then, when one observes a new computer—one with different combinations of fundamental characteristics—one can estimate the price based on its underlying technological specifications and, by comparing to actual purchase price, can infer how much prices for a constant-quality computer have changed.

Chambers applies this approach to teacher salaries, which then become the largest component of an overall price index. He regresses teachers salaries from the Schools and Staffing Surveys (SASS) on characteristics of teachers and on other factors for schools and labor markets. A key element is distinguishing between discretionary factors (factors over which the schools have a choice) and cost factors (exogenous factors over which the schools have no choice). He estimates these relationships for each of the available SASS data sets *(1987–88, 1990–91,* and *1993–94).*

This work makes two advances. First, it recognizes and incorporates school and labor market factors which influence salaries that must be paid (compensating differentials in the labor economics jargon). If school costs in one area are pushed up by factors outside of its control, such as being in a high-crime area, salaries in that area will be higher than in a low-crime area in *order to attract exactly the same quality* person. Similarly, factors about the school district, which must be taken as given by the school personnel, should be adjusted for, because salary differences arising from these should be considered when one tries to compare the price of teachers across districts.

Second, it distinguishes between choice variables of districts and other cost factors. For example, if a district decided to hire only people with Ph.D. degrees and thus paid high average salaries, one would not want to say that it faces a high price for teachers. Instead, one would want to see how the price for similar quality teachers varied and to eliminate decisions about what quality was bought.

The strength of this analysis is that it permits analysis of geographic price differences. Thus, if one is interested in comparing spending across states or different regions, the hedonic price index could be used to adjust for a variety of compensating differentials that affected different labor markets. The measure-

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ment of geographic differences was originally the underlying motivation for this work.

There are, nonetheless, several issues that limit the usefulness of this analysis, particularly in a time series context. At the current time and with the currently available data, it would not provide a sufficiently reliable estimate for routine use in presenting educational spending data.

Sample Selection and Noncompetitive Markets

In other words, the lack of full interaction with competitive labor markets plus the possibility that quality can drift up or down makes the use of observed teacher salaries questionable.

The basic estimation is based on a sample of people employed in teaching in each of the years of the SASS survey. The design incorporates differences in teachers by experience, degree level, quality of undergraduate institution, and personal or demographic factors. If quality of teachers differs other than by these factors, there could be drift up or down in quality that is not considered in the analysis. In other words, unmeasured quality differences could change over time, so that the correction for just the measured discretionary factors could give an inaccurate picture of how prices are changing. This problem is especially relevant for judging teacher salaries, because past research does not suggest that teacher experience or teacher education levels are good measures of teacher quality (defined in terms of student outcomes); see Hanushek (1997a). It is not sufficient if one wishes to measure the quality-adjusted price of teachers simply to point to the fact that schools pay for these attributes. If anything, that complicates the analysis because it ensures that these attributes are correlated with salaries even if they have little to do with quality differences among teachers.

If the teachers in the sample are not representative of the population from which teachers could be drawn, there must be a presumption that the choices of schools do not vary over time, or at least that they do not vary in a systematic manner. On the other hand, this is unlikely because the relative price of college-educated workers has changed systematically over the past quarter century. It is natural to believe that schools make some adjustment in their choices to these changes (see Hanushek and Rivkin 1997).

The adjustment for the specific "discretionary" factors is a clear improvement over using only the average salaries (and making no adjustment). Nonetheless, given the general non-competitive nature of wage determination in the unionized or governmental bargaining situation, the reliance on observed salaries builds in a series of basic decisions by districts. These do not necessarily reflect competitive wages for college graduates or even for people with teacher's training. Moreover, since the quality differences among teachers or potential teachers are not readily observed by districts or by researchers, there is little reason to treat this as a completely separate labor market for purposes of calculating the prices of teachers. In other words, the lack of full interaction with competitive labor markets plus the possibility that quality can drift up or down makes the use of observed teacher salaries questionable. Hanushek and Rivkin (1997) demonstrate that the salaries paid to teachers have tended to drift over the past 40 years, but this drift has not been uniform over time or across males and females.

Instability over time

The estimated hedonic wage equations appear to vary considerably over time. While there are no formal tests of equality of the estimated relationships, either for all of the coefficients or a subset of them, it appears that the point estimates and the statistical significance changes noticeably across years.[5] This presents serious problems, because the estimated correction factors do not seem to mea-

[5] Judging the importance of any differences would require testing the sensitivity of estimated salaries to variations in coefficient values. This has not been done, but the differences look quantitatively quite large for some of the factors.

sure a constant set of quality or cost factors over time. This lack of stability makes it difficult to know how to interpret the basic equations. It also makes it difficult to infer how costs have changed between any survey years when a separate hedonic index is estimated.

An implication is that use of hedonic price indices is very restricted. It is not possible to fill in past price changes (before the 1987–88 SASS). Also, the future is highly dependent upon the continued collection of large and complete data sets.

Alternative Approaches

The two proposed indices—the hedonic-based cost of education index and the output measures of the NSI—seem inappropriate choices for the general measurement of price changes over time in education. Two alternatives seem much better.

Use of a general output deflator

The most straightforward approach would be to employ a general output deflator such as the CPI or the GDP deflator. These indices mark the changes in prices for a market basket of all consumer goods or of final consumer plus investment goods, respectively. As such, when education spending is deflated by one of these, they immediately indicate how much of the society's goods are being given up to purchase education.

This approach does not indicate productivity trends in the education sector because it does not compare real inputs into education with outputs. Nonetheless, it provides a useful benchmark for educational spending.

Note that this is not, however, the same as simply calculating the ratio of education spending to overall GDP. These calculations are suggested by Mishel and Rothstein (1997). This ratio would presumably be normalized by some measure of the number of students.[6] But, even if adjusted for the student population, it presumes that education should rise at the same rate as aggregate income. There is no reason why this assumption should enter into any calculations.

Comparing education spending to overall GDP is not the same as using a good output price index. Nor is there any practical advantage to doing this. The use of an output deflator is easy, because of the readily available time series of price changes. Therefore, there is no feasibility argument favoring the calculation of output comparisons through ratios to aggregate output, GDP, the CPI, or GDP deflator, and there is the distinct possibility that the GDP ratio will produce patterns that are the result simply of the pattern of GDP growth as opposed to real changes in education spending.

Comparing education spending to overall GDP is not the same as using a good output price index.

Generalized hedonic approach

Within the proposed hedonic methodology, it would seem superior to use salary data for entire labor markets. For example, if one thought of the potential supply of teachers as being all individuals with a college degree, it would be possible to calculate how these input prices changed over time. From the Current Population Survey it would be possible to make adjustments for crime and other exogenous factors at the state level. It would not be possible to make fine adjustments at the school or metropolitan area level, however, so the advantages of this approach are tempered by how important one feels differences in these finely constructed factors are.

This approach, which would incorporate part of the ideas of adjustments for exogenous local conditions, has the advantage of being independent of school district choices. Therefore, it is possible to estimate price differences

[6] Because the student population has grown and shrunk at various points, it would not be appropriate to ignore the movements of the quantity of students. If per pupil spending is directly compared to GDP, it is unclear how the GDP figures should be modified, e.g., should it be GDP per capita or GDP per student?

without contaminating them by bargaining or hiring decisions.

This approach permits calculation of annual price adjustments in the future and of past changes from the mid-1960s. Therefore, it provides a readily available and low-cost way of developing an input cost index that adjusts for some of the geographic variations that might be important.

Conclusions

Adjustment of spending in education for price differences is important in a variety of contexts. It is also difficult to do in general because of the possibility of quality changes in outputs and in inputs.

The proposed methods of price adjustment by Mishel and Rothstein (1997) and Chambers (1997) do not, in the author's opinion, provide reliable methods for deflating input spending on schools, although the reasons for their failure are quite different.

The Net Service Index of Mishel and Rothstein (1997) simply has nothing to do with education inputs. It is an output index for a portion of the service sector. As such, it may provide a way of assessing whether productivity decline in education is greater or less than might be expected on the basis of other service sectors. It cannot be used as a deflator of educational inputs.

The hedonic price index proposed by Chambers (1997) introduces several desirable concepts. Its application for general use in analysis over time is limited, however. It relies on salary increases in education, instead of on the changes in the relative costs of college-educated workers. It does not have good measures of quality differences among teachers, but instead uses explicit factors that are part of the hiring and bargaining process of schools. Also, it can only be constructed for years in which there are large surveys of teachers and schools. These factors indicate that this is not a candidate for more general use in deflating education spending.

A modified version of this hedonic analysis that relies on more general labor market information may provide an appropriate input deflator. The efficacy of such an index would, however, require more analysis.

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