

Medical Care Price Indexes

Robert F. Graboyes

Health care expenditures have grown from 4.4 percent of the U.S. economy in 1950 to over 13 percent in 1994. At the same time, medical care prices have risen twice as fast as other prices, according to the Consumer Price Index (CPI). That apparent increase in the price of medical care (relative to other goods and services) would explain by itself the additional spending for health care, though some research suggests that the numbers not be taken at face value. The purpose of this article is to give an understanding of how medical care price indexes are created and why some researchers have expressed concerns about how these indexes are interpreted.

The article is organized as follows: Section 1 introduces the notion and purpose of a price index. Section 2 explains what is meant by quality change and focuses on areas such as the changing efficacy of a medical intervention, the introduction of new goods, and the use of generic drugs. An additional subsection outlines several proposals for the difficult task of constructing a valid price index when quality changes. Section 3 explains some index problems not associated with quality change. Section 4 summarizes the concern that today's indexes may overstate medical inflation. Finally, the appendix gives details on some currently published indexes.

1. LOGIC AND CONSTRUCTION OF PRICE INDEXES¹

A price index measures the average price of a set of goods and services in one period against the average price of the same goods in another period. The central logic is that this basket of goods and services provides an adequate measure of some average purchaser's standard of living or level of satisfaction.

■ This article also appears in the third edition of *Macroeconomic Data: A User's Guide*, Roy Webb, ed. (Richmond: Federal Reserve Bank of Richmond, 1994). The views expressed are those of the author and not necessarily those of the Federal Reserve Bank of Richmond or the Federal Reserve System.

¹ Wallace and Cullison (1981) and Webb and Willemsse (1994) describe in detail procedures used and problems encountered in constructing any macroeconomic price index.

As the price of the basket changes, the index changes proportionally. A 10 percent rise in a medical care price index thus implies a 10 percent increase in the cost of a fixed quantity of medical care for some average purchaser, even though some individual prices will have risen and others will have fallen.

The first task in creating these indexes is to define the limits of medical care: Do we treat cough drops as medicine and include them, or do we call them candy and exclude them? Do we include gymnasium membership dues, since exercise helps prevent illness, or do we count the dues as recreational expenses and exclude them? Once the medical sector or subsector is defined, individual medical price data can be collected. Then these data must be averaged into an index by using some set of arithmetic weights. These weights generally reflect the relative amount spent on each product in some base period. In the CPI, hospital services receive larger weights than aspirin because consumers spend more on hospital services than on aspirin.

2. MEDICAL CARE PRICE INDEXES AND QUALITY CHANGE

Technological progress has changed significantly the quality of medical care in this century, and this is the fundamental complication in producing medical care price indexes. Implicitly, a price index assumes that one's consumption basket does not change over time and a given basket provides a constant level of satisfaction. While these assumptions are never strictly true for any set of commodities, they are especially problematic in medicine. The treatments given in 1944 barely resemble those given in 1994. And the health benefits of a given treatment can change through the years as well.²

The productivity of medical care has advanced greatly over this century. Some of the types of technological progress include the following: [1] **Previously untreatable disease becomes treatable:** In recent decades, heart transplants and coronary bypass operations have given years of life, whereas earlier patients would have died. Therapies such as antibiotics, beta blockers, insulin therapy, and kidney dialysis have effected similar improvements. [2] **Previous treatment replaced by new treatment:** Laparoscopic techniques, using fiber optics and tiny incisions, have largely replaced traditional open surgery in many areas. For example, newer techniques for gallbladder removal require only one to two days in the hospital, compared with three to seven days for traditional surgery. The laparoscopic procedure also results in fewer postoperative complications, less pain, and a shorter convalescence. In addition, some patients for whom traditional surgery is too risky can safely undergo the newer technique.³

² For example, the expected benefit of a heart transplant is much higher in 1994 than it was in 1970, when the operation was still experimental.

³ Legorretta et al. (1993).

[3] **Cheap prevention of costly diseases:** Vaccines against polio, smallpox, and other diseases have provided relatively inexpensive means to eradicate diseases that, if contracted, would impose tremendous costs. [4] **Decreased resource requirements for an existing treatment:** Electronic monitors allow some conditions to be tracked at home rather than in a hospital bed, thus reducing the need for hospital resources. Some cost reductions have resulted more from a change in medical opinion than in any change in technology; for instance, doctors now recommend shorter hospital stays following childbirth. [5] **Movement up the learning curve:** Since the first coronary bypasses were performed, practice and observation have made surgeons more adept at the procedure, resulting in higher success rates.

In some areas of medicine, however, a given level of medical spending may now provide fewer health benefits than in the past. Defensive medicine—care that does not benefit the patient and whose purpose is to avoid malpractice claims—has become a fixture of American medicine.⁴ The health benefits of other procedures are hotly debated—prostate and breast cancer screenings are examples. Heroic end-stage care for the terminally ill is another. A final complication in measuring the quality of medical care is that the population being treated and the illnesses people suffer change over time. It is impossible to neatly compare the productivity of a medical system pre- and post-AIDS, for example.

Quality changes such as these complicate the construction and interpretation of medical care price indexes. Some examples discussed below illustrate difficulties encountered when [1] the efficacy of a good or service changes, [2] new goods are introduced, and [3] old goods are reintroduced under new labels.

Change in Efficacy

Over time, the improved health from using a specific medical commodity often increases (or decreases). This section uses a hypothetical example to demonstrate the analytical difficulties posed by changes in the quality of medical care. Table 1a shows data on a hypothetical economy in which gross domestic product (GDP) consists of two goods: medical procedures (say, an operation) and food. From year 0 to year t , nominal GDP (the sum of spending on food and medicine) grows from \$9.5 million to \$12.2 million. As the expenditures index shows, total purchases have grown 28 percent.

Table 1b uses an alternative measure of medical output. Instead of defining output as the number of procedures performed, this table defines it as the number of lives saved (alternatively, we could use quality of life or some other measure of medical outcome). According to these figures, there has been a

⁴ Brostoff (1993) describes a study by Lewin-VHI, Inc., that estimated the costs of defensive medicine to be \$36 billion per year.

**Table 1a Measuring Aggregate Price and Quantity Changes:
Medical Procedures and Food**

	Medical Procedures	Food	Indexes (year 0 = 100)
Year 0			
Expenditures	500,000	9,000,000	100
Quantity	1,000	100,000	100
Price	500	90	100
Share of economy	5.3%	94.7%	
Year t			
Expenditures	1,200,000	11,000,000	128
Quantity	2,000	110,000	115
Price	600	100	112
Share of economy	9.8%	90.2%	

Interpretation: Index = 128 implies 28 percent growth over the period. Calculation of year t indexes:

$$\text{Expenditure: } 128 \approx 100 \times \frac{1,200,000 + 11,000,000}{500,000 + 9,000,000}$$

$$\text{Price: } 112 \approx 100 \times \left(5.3\% \times \frac{600}{500} + 94.7\% \times \frac{100}{90} \right)$$

$$\text{Quantity: } 115 \approx 100 \times \frac{\text{Expenditure Index}}{\text{Price Index}}$$

dramatic quality change in the medical procedure. Thirty percent of the patients survive in year t (600 out of 2,000), compared with only 10 percent in year 0 (100 out of 1,000). Because of this, the price of one life saved has *dropped* from \$5,000 to \$2,000, compared with an *increase* in the price per procedure from \$500 to \$600.

Inflation is measured in Table 1b as 7 percent, compared with Table 1a's rate of 12 percent. Real economic growth is 15 percent in Table 1a and 20 percent in Table 1b. The practical effects of such measurement discrepancies are not trivial. Throughout the economy, wage contracts, government benefits, taxes, and other contractual arrangements tie payments to changes in the general price level. It matters to a company whether its workers should be given a 12 percent or a 7 percent cost-of-living increase.

For most purposes, it would be better to measure growth as in Table 1b rather than as in Table 1a, since it is lives saved and not procedures performed that indicate economic well-being. We can guess, for example, that improvements in X-ray machines and in doctors' abilities to read X-rays have led to a greater efficacy in the use of X-rays. How much sooner, on average, are

**Table 1b Measuring Aggregate Price and Quantity Changes:
Lives Saved and Food**

	Lives Saved	Food	Indexes (year 0 = 100)
Year 0			
Expenditures	500,000	9,000,000	100
Quantity	100	100,000	100
Price	5,000	90	100
Share of economy	5.3%	94.7%	
Year t			
Expenditures	1,200,000	11,000,000	128
Quantity	600	110,000	120
Price	2,000	100	107
Share of economy	9.8%	90.2%	

Interpretation: Index = 128 implies 28 percent growth over the period. Calculation of year t indexes:

$$\text{Expenditure: } 128 \approx 100 \times \frac{1,200,000 + 11,000,000}{500,000 + 9,000,000}$$

$$\text{Price: } 107 \approx 100 \times \left(5.3\% \times \frac{2,000}{5,000} + 94.7\% \times \frac{100}{90} \right)$$

$$\text{Quantity: } 120 \approx 100 \times \frac{\text{Expenditure Index}}{\text{Price Index}}$$

cases of disease found in 1994 than in 1954 on a per-X-ray basis? How much more does the average X-ray extend or improve life today? Even if we could accurately answer these questions, what would be the dollar value of each improvement? Since the answers are difficult to even approximate, analysts in statistical bureaus with limited budgets usually shrug their shoulders and use the number of X-rays to represent output, rather than using some measure of abatement of disease or extension of life.

The difficulty in distinguishing quality, quantity, and price changes exists for all goods and services. For example, a pound of chicken in 1994 is not the same product as a pound of chicken was in 1924. The taste, consistency, and nutritional characteristics have all changed. Also, the qualities of a computer in 1994 are vastly different from what they were in 1974. At least for these tangible products, one can imagine how quality might be defined. With services, however, the difficulty in defining output makes it especially problematic to measure changes in the quality of that output. In no service industry is the effort more daunting than in medicine. Measuring medical care production in terms of the means (procedures) rather than the ends (good health) is somewhat

akin to measuring vegetable prices in dollars per acre planted rather than dollars per bushel of yield. The former would lead us to mistakenly measure increased yields per acre from added fertilizer as inflation.

New Goods Problem

Another serious indexing problem is that new products and technologies have been introduced rapidly into medicine (and other industries) in the last 50 years. Price index weights, however, are revised only infrequently. As a result, price indexes may miss significant reductions in the cost of living. Gordon (1992) writes that “penicillin entered the CPI in 1951, after it had already experienced a 99 percent decline from its initial price” (p. 9). Berndt, Griliches, and Rosett (1993) examined the new goods problem with respect to the introduction of new pharmaceuticals. They found that the Bureau of Labor Statistics (BLS) tends to give insufficient weight to newer products and that these products tend to experience lower-than-average price increases. Together, these two tendencies would bias the measured price increases upwards.

We can illustrate the mechanics of the new goods problem by departing from medicine for a moment and considering two familiar products from the electronics industry. Suppose a long-term price series used 1940 expenditure weights. There would be no weight for the transistor, and the skyrocketing price of vacuum tubes would appear to contribute to inflation. Of course, vacuum tube prices are up largely because the production volumes have become small. The invention of the transistor has greatly *reduced* the cost of devices that amplify and rectify electronic signals.

While the BLS deals with the new goods problem in several ways, the most common process is called “linking” in which, at some arbitrary point, one good is dropped and the other added. Importantly, the new good is introduced in such a way that this replacement leaves the price level unchanged.

The data in Table 2 provide a hypothetical example of linking. Suppose drug A is replaced over time by drug B, but that for a time both are on the market. The first two columns represent the prices of drug A and drug B in years 1 through 6. The price of drug A is rising due to general inflation and other factors. New products like B frequently will decline in price after introduction because [1] through experience the company entering the market improves its manufacturing techniques, [2] the new company increases its market share and can take advantage of economies of scale, and [3] close substitutes increasingly compete with profitable established products. The next-to-last column represents a price index that, beginning in year 2, reflects changes in the price of drug B. The last column represents an index that reflects drug A prices until year 5 and then switches to drug B. The problem is deciding at what point to drop drug A and to add drug B. This table shows that such a choice may completely change the message sent by the price index. Again, this problem

Table 2 Linking Old and New Goods in a Price Index

Year	(Old) Drug A Price	(New) Drug B Price	Price Index: Drug B Added in Year 2	Price Index: Drug B Added in Year 5
1	100	420	100 (base year)	100 (base year)
2	130	390	$93 \approx 100 \times 390 \div 420$	$130 \approx 100 \times 130 \div 100$
3	140	370	$88 \approx 93 \times 370 \div 390$	$140 \approx 130 \times 140 \div 130$
4	160	340	$81 \approx 88 \times 340 \div 370$	$160 \approx 140 \times 160 \div 140$
5	190	380	$90 \approx 81 \times 380 \div 340$	$179 \approx 160 \times 380 \div 340$
6	240	470	$112 \approx 90 \times 470 \div 380$	$221 \approx 179 \times 470 \div 380$

Notes: If drug B replaces drug A in the price index in year 2, the index shows a smaller price rise than if B replaces A in year 5. This is because the year 5 link misses drug B's price decline in the first few years. Calculations are not exact due to rounding.

may be more serious in medicine than in most other sectors of the economy. The relative costs and benefits of transistors and vacuum tubes can be defined in fairly objective terms, while new drugs are rarely as easy to compare.

Old Goods, New Label Problem—Generic Drugs

A variant on the new goods problem is the case in which an existing good is reintroduced to the market under a new label, as in the case of generic drugs. Following is a hypothetical example illustrating the generic drug problem described by Scherer (1993). Suppose that [1] a name-brand drug X costs one dollar per pill, [2] a biochemically identical generic drug Y is introduced at fifty cents per pill, [3] half the market switches from X to Y. If one treats X and Y as a single drug, then the average price has dropped by 25 percent, since purchasers of the pills are now paying 25 percent less on average than they used to.

In fact, this change will not normally show up in the CPI as a price reduction. First, weights in the CPI market basket are changed infrequently. CPI data are collected on specific brands, like our drug X. Until the weights are revised, the price of brand Y will not enter into the calculation of the CPI. Second, when the generic drug Y is added to the CPI market basket, it will be added into the index as a new product, separate from name-brand drug X. Thus, the addition of Y to the basket will not show up as a decline in price.

Price indexes indicate generally that pharmaceuticals prices have risen at a high rate compared with general inflation or even with other parts of the medical sector. Scherer (1993), Berndt, Griliches, and Rosett (1993), and Griliches and Cockburn (1993) examine this trend and conclude that mismeasurement is partly to blame. This mismeasurement occurs in part because of the way generic drugs are introduced into indexes such as the CPI.

Alternative Approaches to Measuring Medical Care Prices

Researchers have suggested alternative ways of measuring medical output that might yield better estimates of medical prices than do current procedures. Wilensky and Rossiter (1986) describe four ways of measuring medical care output: the procedure (e.g., one day's radiation therapy), the case (e.g., a cancer, from diagnosis to conclusion of treatment), the episode (e.g., a particular period of the illness), and per capita (e.g., the patient's total health care, including the cancer). Procedure-based indexes are the most commonly used today, but alternative indexes have been proposed that would use alternative units of output.

Health Insurance Premiums as Price Proxies

Some researchers have suggested that a good indicator of price increases might be found in the premiums paid on a standard health insurance policy.⁵ The logic is that an insurance policy represents a fixed bundle of medical goods and services, and if quality remains constant, the price of the policy will represent the price of that bundle. This idea found some favor in the late 1960s, when, it can be argued, health insurance policies were fairly standardized. Problems with that approach have become apparent, however, as policies have grown less uniform, with broad differences in copayments, deductibles, payout limits, and services provided. Technological and other changes in medicine mean that a policy today provides very different care from an identical policy 30 years ago; thus, quality changes are as big a problem as they are with a procedure-based measure. Also, the real values of policies differ across states, since each state's regulatory practices partially determine the insurance companies' liabilities. Finally, the quantity of medical care demanded by the average policyholder differs across localities.

Costs of Treatment of a Representative Group of Illnesses

Scitovsky (1964) proposed taking a group of illnesses and measuring how the prices of treating those illnesses changed over time.⁶ Instead of measuring inputs like hospital beds, operations, and drugs, this approach would take an occurrence of a number of illnesses—say, a case of pneumonia, a brain tumor, and a broken leg—and measure the total costs of treating this set of illnesses. Quality change would still be a problem, though, since the means of treating a particular disease changes over time. This proposal did suggest adjusting the measured treatments for quality, using indicators like infant mortality and age-adjusted death rates per numbers of cases as proxies for quality. Scitovsky was

⁵ This idea is discussed in Feldstein (1993), pp. 71–72. Feldstein also refers readers to Reder (1969), p. 98, and Barzel (1969).

⁶ This proposal is described in Feldstein (1993), pp. 64–71.

concerned, however, that simple quality adjustments such as these would be inadequate, given the complexity of measuring medical outcomes.

Hedonic Pricing

One method of adjusting for quality that has been used by statistical agencies and academic researchers is hedonic pricing. Hedonic pricing values a good by assuming that the good is really a bundle of characteristics and that there are separate demands for each of these characteristics. In measuring price changes in computers, for example, the Bureau of Economic Analysis uses a model that breaks the computer down into a set of characteristics (e.g., number of calculations per unit of time), and then measures the prices of those characteristics. Recombining these separate prices yields an estimated price for a computer, holding quality constant (see Triplett [1986]). In this approach, quality is merely the sum of a group of quantities.

An example of the hedonic approach applied to medical equipment is Trajtenberg (1990). He compares three price indexes for Computerized Tomographic X-ray devices (CT or CAT scanners): [1] a standard index with no adjustment for quality change; [2] a hedonic index, assuming that a CAT scanner is really a bundle of four characteristics (head vs. body, scan time, resolution, and image reconstruction time); and [3] a welfare-change index based on the same four characteristics, but designed for a very different objective—measuring the consumer's well-being rather than the price of these four characteristics. Over the period 1973 to 1982, the standard index *increases* from 100 to 259.4, the hedonic price index *decreases* from 100 to 27.3, and the welfare-change index decreases from 100 to .07. Thus, one methodology produces a price index 3,700 times higher than does another price index. As Getzen (1992) writes:

Differences of this magnitude in only a few items would be sufficient to show that rather than being the fastest rising component of the [general price level], the real quality-adjusted price of medical care is falling—a conclusion that would be confirmed by most rational consumers given a choice of 1931 medicine at 1931 prices and the medical technology of 1991 at 1991 prices.

(P. 116)

Hedonic pricing may provide a promising approach for some goods. However, the procedure adds markedly to the cost of data, and not all goods and services are good candidates for the procedure.

3. OTHER PROBLEMS

The passages below describe several index problems not associated with quality changes. They include [1] the use of list prices instead of transaction prices, [2] statistical sampling problems, [3] the measuring problems introduced by health insurance policies, and [4] substitution bias.

Transaction Versus List Prices

Price indexes may sometimes use data from list prices rather than actual transaction prices. Ideally, price indexes should include only transaction prices. In many medical care transactions, the discrepancies are large. For example, a hospital bill may state the charge for a procedure as \$600, but Medicare may reimburse the hospital only \$400. If the hospital receives no additional compensation from the patient or from private insurers, then \$400 should be the price of the procedure used in compiling the price index. Unfortunately, it is often the case that list prices are easier to come by than transaction prices, so it is these fictional list prices that are used in the index.

If discounts (or the ratio of list to transaction prices) were constant over time, this problem would not be particularly pernicious. Medical discounts, however, have grown rapidly over recent decades, so the use of list prices appears to have imparted an upward bias to reported increases in medical care prices.⁷

Sampling Problems

In a world of costless data collection, an ideal index of medical care prices would incorporate the price of every single medical transaction that actually takes place, down to every individual box of aspirin sold. Collecting one price for each individual transaction, though, is impractical or impossible, so the producer of a price index must drastically reduce the number of prices collected by sampling. Instead of measuring the price of every single aspirin purchased in America in October, the statistician can more readily measure only the list price for brand X aspirin at five stores each in one hundred localities on October 12. The effects of such sampling are not neutral, and the sample may therefore misrepresent the total aspirin purchases nationally. Analysts have identified several ways in which typical procedures could distort price indexes. For example, list prices may be higher than actual prices paid because of routine store discounts. Much aspirin may be purchased by bulk users such as clinics who pay less than list prices. Brand X may be higher-priced than store brands. The localities and stores selected may be unrepresentative. And Columbus Day may be a poor day to sample prices because many stores will have one-day discounts.

Medical Insurance

Getzen (1992, p. 85) notes that the problem of measuring medical prices is further complicated by medical insurance. Most medical payments in the United

⁷ For example, the hospital component of the CPI, which uses list price data, consistently rises faster than does either the HCFA Hospital Transaction Output Price Index or the PPI Hospital Services Index, both of which use transaction price data (see Table 3). Bottiny (1993, p. 32) cites figures showing that from 1984 to 1988, California hospital list prices (charges billed) increased by 11.1 percent annually, while transaction prices increased by 7.0 percent.

States are made through public or private insurance policies. Payments under these policies make it difficult or impossible to separate out the prices paid by specific individuals for specific procedures. Insurance has exacerbated the problem of “cost-shifting.” This problem arises when one group of patients is charged more than the full cost of treatments in order to subsidize another group whose charges do not fully cover treatment costs. Health care providers often make up losses on Medicare and Medicaid patients by raising prices to other patients, thus causing some prices to be overstated and others to be understated. If (as with the medical component of the CPI) the sample mostly measures payments by non-Medicare, non-Medicaid patients, then an increase in cost-shifting will impart an upward bias to the index.

Choice of Weights and Substitution Bias

A price index is simply a weighted average of prices, and the weights are generally derived from the mix of items consumed across the economy. The consumption mix, though, changes dramatically over time in response to shifts in relative prices and other factors, and the choice of weights is important. In Table 1b, medical expenditures rise from 5.3 percent of output to 9.8 percent. Based on year 0 weights (5.3 and 94.7 percent), the price level rises from 100 to 107. Based on year t weights (9.8 and 90.2 percent), however, the price level would rise from 100 to only 104 (9.8 percent \times 2000/5000 + 90.2 percent \times 100/90). In the U.S., most price indexes use the first method, infrequently changing weights.

A general principle in economics is that as the price of one good rises, consumers tend to shift at the margin out of that good and substitute into other goods whose prices are falling or rising more slowly. In Table 1b, for example, the shift in spending toward medical procedures may result from the decline in the price of one life saved relative to the price of one unit of food purchased. With fixed expenditure weights, these demand shifts will be missed and the price index will give too much weight in later years to the good whose price is rising fastest, a statistical phenomenon known as substitution bias. As a practical matter, substitution bias appears to be fairly small in most price indexes and is dwarfed by quality-measurement problems.

4. SUMMARY: RISING EXPENDITURES VERSUS RISING PRICES

This article has explained why some researchers suspect that the CPI and other indexes systematically overstate (or, possibly, understate) the rise in medical prices, though the case is difficult to quantify with any precision. True medical outputs (the number of lives saved, improvement in patients’ quality of life, relief from pain, etc.) are difficult or impossible to measure. For this reason,

statisticians usually substitute quantities of inputs (number of coronary bypasses performed, number of hospital days), treating them statistically and semantically as if they were outputs. To some extent, this problem of disentanglement exists for all goods and services, but the undeniable but difficult-to-quantify progress in health care implies that the problem must be especially troubling in medicine. [See next page for a listing of papers and articles on this subject.]

Quality changes in medical care compound the problem, since a price index implicitly assumes that the quality of the underlying good or service does not change over time. In medicine, evolving technology and treatment regimes have steadily increased the quality of medical care over the past half century. To the extent that price indexes overstate medical inflation, these errors, in turn, will cause price indexes like the CPI to overstate general inflation. And the impact of any such errors may grow in the future because, according to some projections, medical care may grow from the present 13 percent of the national economy to 20 percent by 2010.

Perhaps the largest cost of measurement errors would be inappropriate policy decisions. Much of the present debate on health care reform is premised on the “fact” that medical prices have grown faster than those of most other goods and services. One can imagine that today’s health policy debate and proposals would be very different were there a general perception that medical prices were growing slowly.

APPENDIX

A REFERENCE GUIDE TO PUBLISHED INDEXES

A number of price indexes are produced, each based on a segment of national health expenditures (NHE). The Consumer Price Index (CPI) is perhaps the best-known measure of aggregate price changes in the U.S. economy. Similarly, the Medical Care Price Index (MCPI), the medical component of the CPI, is the best-known measure of price changes in the medical sector and is often cited as representing “the” rate of inflation in medical care. It should be noted, however, that the MCPI covers a basket of goods and services that in many ways is unrepresentative of national health expenditures, as is explained later in this section.

Numerous other indexes measure medical care price changes—some in narrower ranges of transactions than those entering the MCPI, and some in broader ranges. The MCPI, however, must be considered the paramount medical price series. Data from the MCPI are used as proxies for prices and weights in producing most other medical care price series. Thus, whatever problems exist in the MCPI filter through into almost all other series. Many series also borrow

The following papers and articles discuss possible sources of biases in medical price series. The majority, though not all, presume that the biases are upward.

Article	Concerns Addressed Include
Armknecht and Ginsburg (1990)	The CPI may understate medical insurance cost increases.
Berndt, Griliches, and Rosett (1993)	The CPI fails to incorporate price decreases associated with generic drugs.
Bottiny (1993)	The CPI may overstate medical inflation because of [1] the exclusion of most government health expenditures (which have risen less than private payments) from the MCPI, [2] substitution bias, and [3] the heavy reliance on list prices rather than transaction prices.
Cleeton, Goepfrich, and Weisbrod (1992)	Lags in introducing new drugs, plus the lack of information on effectiveness and safety of drugs, may bias the CPI either upwards or downwards.
Getzen (1992)	Traditional price indexes are not suitable for use as deflators of health expenditures.
Griliches and Cockburn (1993)	The CPI fails to incorporate price decreases associated with generic drugs.
Kroch (1991)	The CPI fails to adjust for changes in the quality of medical care associated with, for example, hospital room modifications, nurse-to-patient ratios, and introduction of new technologies.
Lebow, Roberts, and Stockton (1992)	The CPI fails to incorporate price decreases associated with new goods.
Madigan (1991)	The CPI fails to adjust for improvements in the quality of medical care.
Newhouse (1988)	The source of medical expenditure increases cannot be determined because the CPI [1] measures the prices of inputs, not outputs, [2] uses list prices, not transaction prices, [3] largely ignores technological change, and [4] uses inappropriate weights.
Scherer (1993)	The CPI has shortcomings in how it absorbs generic drugs, new products, and quality improvements.
Trajtenberg (1990)	Because of quality changes, the CPI may dramatically overstate increases in CAT scanner prices.
Tregarthen (1993)	The CPI relies on list prices and fails to adjust for quality changes.

data from other series produced by the Department of Labor, the Department of Commerce, the Health Care Financing Administration, the American Medical Association, the American Hospital Association, and others. So, all the medical care price series tend to share many of the same methodological problems.

The following section contains comparative information on a number of currently available medical care data series. Entries generally include the following sections:

Coverage: The basket of goods and services whose average price the index measures

Purpose: The reason for producing the index

Years/Periodicity: The years of available data and the periodicity (e.g., annual, quarterly, monthly)

Source: The organization that produces the index

Reported: The publication in which data can be found

References: Articles or books explaining the index

Miscellaneous: Other pertinent information

Historical data on these series are found in Table 3.

Medical Care Price Index (MCPI)—Coverage: A basket of goods and services representing consumers' out-of-pocket medical expenditures—roughly 20 percent of the expenditures included in national health expenditures. Does not include most medical costs paid for by public or private insurance programs. Includes health insurance premiums paid directly by the consumer, but not those paid by employers or governments. **Purpose:** Comprises part of the Consumer Price Index (CPI). The CPI is widely used as a benchmark for adjusting contractual payments, including wage and Social Security payments, for inflation. **Years/Periodicity:** 1936–1946/quarterly; 1947–present/monthly. **Source:** U.S. Department of Labor, Bureau of Labor Statistics. **Reported:** In *Monthly Labor Review*. **References:** *BLS Handbook of Methods* (1992, ch. 19); Getzen (1992); Feldstein (1993). **Miscellaneous:** The absence of payments made by public and private insurance policies is a weakness if one is using the MCPI as a proxy for overall medical inflation; however, the MCPI is not produced with that purpose in mind.

National Health Expenditures (NHE) Deflator—Coverage: All medical care goods and services included in National Health Expenditures, a measure of total medical care spending. **Purpose:** To measure price movements in the entire medical sector. **Years/Periodicity:** Series under development as of November 1994. **Source:** Health Care Financing Administration (HCFA). **Reported:** Available on request from HCFA, Office of the Actuary.

Table 3 Annual Percentage Change in Medical Care Price Indexes

Price Index	Dec-29 to Dec-51	Dec-51 to Dec-65	Dec-65 to Dec-69	Dec-69 to Dec-80	Dec-80 to Dec-93	Years of Data
CPI	3.9%*	1.3%	4.3%	7.5%	4.0%	1935–93
MCPI	2.8%*	3.2%	6.1%	7.9%	7.5%	1935–93
Medical Care Commodities	2.7%*	0.7%	0.3%	4.9%	7.1%	1947–93
Professional Medical Services			5.8%*	7.4%	6.5%	1967–93
Dental Services	3.1%*	2.3%	5.4%	6.9%	6.5%	1935–93
Eye Care					3.8%*	1986–93
Hospital and Related Services				11.7%*	9.0%	1977–93
NHE Deflator			Data series under development as of November 1994			
PCE, Fixed-Weight, Medical Component	2.5%	3.4%	6.6%	7.8%	6.7%	1929–93
PHCE Deflator		2.3%*	5.4%	7.4%	7.1%*	1960–91
MEI					3.7%	1980–93
AHA Hospital		3.2%*	6.4%	8.0%	6.7%	1963–93
HCFA PPS Hospital					4.6%	1980–93
HCFA Hospital Transaction Output Price Index		3.5%*	6.6%	8.2%	6.7%	1960–93
HCFA Nursing Home				8.3%*	4.9%	1972–93
NHA-BEA Nursing Home				8.0%*	5.2%	1972–93
HCFA Home Health				8.3%*	5.7%	1972–93
PPI: Drugs and Pharmaceuticals	−2.8%*	−0.5%	0.0%	5.4%	6.5%	1947–93
PPI: X-Ray/Electromedical				8.5%*	1.7%	1971–93
PPI Hospital Services					4.0%*	1992–93

*Data available for only part of the period (see right-hand column for dates).

Notes: All series are discussed in text, except the five MCPI components. The time periods approximately delineate periods in which medical prices were subject to distinctive influences, as follows: 1935–1951: moderate technological change, most payments made out-of-pocket by patients, Great Depression, World War II; 1951–1965: faster technological change, rapid growth of private medical insurance; 1965–1969: introduction of Medicare and Medicaid; 1969–1980: high general inflation, low economic growth, rapid technological progress; 1980–1993: lower general inflation.

Personal Consumption Expenditures (PCE), Fixed-Weight Index, Medical Component—Coverage: Payments for individuals' medical care—approximately 88 percent of national health expenditures. Includes payments made by individuals and by public and private insurance programs. Does not include expenditures such as medical research and certain construction expenses. **Purpose:** PCE comprises part of the National Income and Product Accounts, and fixed-weight price indexes are produced for an array of NIPA segments. **Years/Periodicity:** 1929–1946/annual; 1947–present/quarterly. **Source:** U.S. Commerce Department, Bureau of Economic Analysis. **Reported:** *Survey of Current Business*. **References:** Getzen (1992), p. 96. **Miscellaneous:** The BEA formerly produced a deflator of the PCE medical component, but these data are no longer distributed.

Personal Health Care Expenditures (PHCE) Deflator—Coverage: Includes public and private spending for direct health and medical services to individuals. Included are expenditures for hospital care, physician services, dental services, other professional services, drugs and other medical nondurables, vision products and other medical durables, and nursing home care. Does not include medical research, construction of medical facilities, public health activities (e.g., disease prevention and control), program administration, and the net cost of private health insurance. **Purpose:** To provide a broad-based measure of medical care inflation that addresses some of the methodological problems inherent in the MCPI—the CPI's narrow expenditure base, for example. **Years/Periodicity:** 1960–1991/annual. **Source:** Health Care Financing Administration (HCFA). **Reported:** *Health Care Financing Review*. **References:** Letsch (1993).

HCFA Medicare Economic Index (MEI)—Coverage: Inputs to physician office services (roughly 25 percent of national health expenditures), plus an adjustment for economy-wide productivity growth. Inputs include physician earnings, nonphysician earnings, office expenses, medical materials and supplies, professional liability costs, medical equipment, and some other goods and services. **Purpose:** Used in annual updates of Medicare's physician fee schedule. The Secretary of Health and Human Services considers the MEI in recommending a new schedule to Congress. If Congress takes no action, the MEI is used in calculating an automatically updated schedule. **Years/Periodicity:** 1980–present/quarterly; ten-year forecasts. **Source:** Health Care Financing Administration (HCFA). **Reported:** *Federal Register*. **References:** For a fuller description of the data sources and of the Medicare Economic Index in general, see Office of the Federal Register (1992, 1993) and Freeland, Chulis, Arnett, and Brown (1991). **Miscellaneous:** By congressional intent, the MEI is backward-looking rather than forward-looking because Congress believed that increases in Medicare reimbursements should follow, rather than lead, inflation.

AHA Hospital Market Basket Index—Coverage: Hospital expenditures—roughly 40 percent of national health expenditures in 1991. It is an input

price index for hospitals, measuring the changes in prices of hospital inputs—the goods and services hospitals buy. **Purpose:** To serve as a guideline in contract negotiations between hospitals and their contractors. Deflates hospital expenditures over time in order to produce measures of real hospital spending growth. **Years/Periodicity:** 1963–present/monthly. **Source:** The American Hospital Association (AHA). **Reported:** Quarterly in AHA's *Economic Trends*. **References:** This index and the HCFA Hospital Market Basket Index are compared in Dyer and Li (1990). **Miscellaneous:** Uses fixed-expenditure weights that do not vary over time.

HCFA Prospective Payment System (PPS) Hospital Input Price Index—Coverage: Hospital expenditures—roughly 40 percent of national health expenditures in 1991. Input price index for hospitals. Measures the changes in prices of the goods and services hospitals buy as inputs into their production of goods and services. Used in the Medicare PPS update formula to adjust hospital reimbursements for year-to-year inflation. **Purpose:** To provide a regulatory baseline for adjusting the schedule of fees paid to hospitals under Medicare and Medicaid. **Years/Periodicity:** 1986–present/quarterly. Backcast data also have been produced for 1980–1986. **Source:** Health Care Financing Administration (HCFA). **Reported:** *Federal Register*. **References:** Office of the Federal Register (1990); Freeland, Anderson, and Schendler (1979); Freeland, Chulis, Brown et al. (1991), Freeland and Maple (1992). The HCFA and AHA indexes are compared in Dyer and Li (1990). **Miscellaneous:** Uses fixed-quantity weights, where the quantities are fixed from a base year but relative importance shares change over time as prices change.

HCFA Hospital Transaction Output Price Index—Coverage: Estimates the price of hospital outputs rather than inputs. To do so, the index uses list price data to estimate transaction price data. **Purpose:** Seeks to measure the rate of growth in transaction prices (rather than list prices) for hospital goods and services. Because of increasing volume discounts for large purchasers, list prices may overstate the actual growth in costs. **Years/Periodicity:** 1960–1993/annual. **Source:** Health Care Financing Administration (HCFA). **Reported:** Not formally reported, but available through HCFA. **References:** Fisher (Spring 1992, Fall 1992). **Miscellaneous:** There are two versions of this index. One uses patient revenues, while the other uses total revenues, of which patient revenues are only a part.

HCFA Regulation Skilled Nursing Home Input Price Index—Coverage: A market basket of the most commonly used nursing home inputs—approximately 8 percent of national health expenditures. **Purpose:** To reimburse skilled nursing facilities' inpatient routine service costs under Medicare. **Years/Periodicity:** 1972–present/quarterly. **Source:** Health Care Financing Administration (HCFA). **Reported:** Biannually in the *Federal Register*. **References:** Office of the Federal Register (October 7, 1992).

National Health Accounts—Bureau of Economic Analysis (NHA—BEA) Nursing Home Input Price Index with Capital Costs—Coverage: Inputs, including capital, for the production of nursing home services. **Purpose:** To estimate and project growth in nursing home prices while holding constant content of per-diem services, productivity, and profit margins. **Years/Periodicity:** 1972–present/quarterly. **Source:** Health Care Financing Administration (HCFA). **Reported:** Available on request from HCFA, Office of the Actuary.

HCFA Regulation Home Health Agency Input Price Index—Coverage: Goods and services used in producing home health care services—just over 1 percent of national health expenditures. **Purpose:** To determine reimbursement limits under Medicare. **Years/Periodicity:** 1972–present/quarterly. **Source:** Health Care Financing Administration (HCFA). **Reported:** Periodically in the *Federal Register*. **References:** *Federal Register* (July 7, 1992).

Producer Price Index (PPI): individual medical components—Coverage: Medical goods sold by producers, including both intermediate and final goods. The PPI covers goods used as inputs to medical care, though there is no aggregate index of medical producer prices. Two of the most important categories are drugs and pharmaceuticals and X-ray and electromedical machinery. **Purpose:** To construct the overall PPI. **Years/Periodicity:** Drugs and pharmaceuticals: 1947–present/monthly; X-ray and electromedical machinery: 1971–present/monthly. **Source:** U.S. Department of Labor, Bureau of Labor Statistics. **Reported:** *Producer Price Indexes* monthly publication of data. **References:** Various PPI releases from the BLS. **Miscellaneous:** Traditionally, the PPI has covered only goods, so much of the medical care industry has been excluded. However, several areas of medical services have recently been added to the PPI's coverage (see PPI—Hospitals, below).

Producer Price Index (PPI) Price Indexes for Hospitals—Coverage: These indexes for various classes of hospitals (general, psychiatric, etc.) are based on output data—the revenues paid to hospitals for an average hospital stay or outpatient treatment. **Purpose:** In 1993, the BLS began producing indexes of hospital prices as part of a long-range plan to incorporate service industries into the PPI. **Years/Periodicity:** 1993–present/monthly. **Source:** U.S. Department of Labor, Bureau of Labor Statistics. **Reported:** *Producer Price Indexes* monthly data publication. **References:** U.S. Department of Labor (1993), p. 5. **Miscellaneous:** Similar indexes have been or will be introduced in 1994 for physician services, medical laboratories, and nursing care facilities.

REFERENCES

- Armknrecht, Paul A., and Daniel H. Ginsburg. "Improvements in Measuring Price Changes in Consumer Services: Past, Present, and Future," in Zvi Griliches, ed., *Output Measurement in the Service Sectors, NBER Studies in Income and Wealth Volume 56*. Chicago: University of Chicago Press, 1992.
- Barzel, Yoram. "Productivity and the Price of Medical Services," *Journal of Political Economy*, vol. 77 (November–December 1969), pp. 1014–27.
- Berndt, Ernst R., Zvi Griliches, and Joshua G. Rosett. "Auditing the Producer Price Index: Micro Evidence from Prescription Pharmaceutical Preparations," *Journal of Business and Economic Statistics*, vol. 11 (July 1993), pp. 251–64.
- Bottiny, Walt. "Is Medical Care Consumer Price Inflation Overstated?" *DRI/McGraw-Hill Cost and Price Review*, Second Quarter 1993, pp. 31–33.
- Brostoff, Steven. "Eliminate Defensive Medicine, Save \$36: Study," *National Underwriter*, vol. 97 (February 8, 1993), p. 5ff.
- Cleeton, David L., Valy T. Goepfrich, and Burton A. Weisbrod. "What Does the Consumer Price Index for Prescription Drugs Really Measure?" *Health Care Financing Review*, vol. 13 (Spring 1992), pp. 45–51.
- Dyer, Carmela, and Weiwei Li. "A Comparison of the AHA and HCFA Market Basket Indices." American Hospital Association Policy Brief #90-01. March 23, 1990.
- Feldstein, Paul J. *Health Care Economics*, 4th ed. Albany: Delmar Publishers, 1993.
- Fisher, Charles R. "Hospital and Medicare Financial Performance Under PPS, 1985–90," *Health Care Financing Review*, vol. 14 (Fall 1992), pp. 171–83.
- _____. "Trends in Total Hospital Financial Performance Under the Prospective Payment System," *Health Care Financing Review*, vol. 13 (Spring 1992), pp. 1–16.
- Freeland, Mark, and Brenda T. Maple. "U.S. Health Input Price Index Developed by HCFA," *Health Expenditure Analysis Letters*, vol. 1 (Summer 1992). Philadelphia: Temple University School of Business and Management.
- Freeland, Mark S., Gerard Anderson, and Carol Ellen Schendler. "National Hospital Input Price Index," *Health Care Financing Review*, vol. 1 (Summer 1979), pp. 37–61.

- Freeland, Mark S., George S. Chulis, Ross H. Arnett, III, and Aaron P. Brown. "Measuring Input Prices for Physicians: The Revised Medicare Economic Index," *Health Care Financing Review*, vol. 12 (Summer 1991), pp. 61–73.
- Freeland, Mark S., George S. Chulis, Aaron P. Brown, David Skellan, Brenda T. Maple, Naphtale Singer, Jeffrey Lemieux, and Ross H. Arnett, III. "Measuring Hospital Input Price Increases: The Rebased Hospital Market Basket," *Health Care Financing Review*, vol. 12 (Spring 1991), pp. 1–13.
- Getzen, Thomas E. "Medical Care Price Indexes: Theory, Construction, & Empirical Analysis of the US Series 1927–1990," *Advances in Health Economics and Health Services Research*, vol. 13 (1992), pp. 83–128.
- Gordon, Robert J. "Measuring the Aggregate Price Level: Implications for Economic Performance and Policy," Working Paper 3969. Cambridge, Mass.: National Bureau of Economic Research, January 1992.
- Griliches, Zvi, and Iain Cockburn. "Generics and New Goods in Pharmaceutical Price Indexes," Working Paper 4272. Cambridge, Mass.: National Bureau of Economic Research, February 1993.
- Kroch, Eugene. "Tracking Inflation in the Service Sector," Federal Reserve Bank of New York *Quarterly Review*, vol. 16 (Summer 1991), pp. 30–35.
- Lebow, David E., John M. Roberts, and David J. Stockton. "Economic Performance Under Price Stability," Working Paper 125. Washington: Board of Governors of the Federal Reserve System, April 1992.
- Legorretta, Antonio P., Jeffrey H. Silber, George Costantino, Richard W. Kobylinski, and Steven L. Zatz. "Increased Cholecystectomy Rate After the Introduction of Laparoscopic Cholecystectomy," *JAMA*, vol. 270 (September 22/29, 1993), pp. 429–32.
- Letsch, Suzanne W. "DataWatch: National Health Care Spending in 1991," *Health Affairs*, Spring 1993, pp. 105–10.
- Madigan, Kathleen. "How Reliable Is the Consumer Price Index?" *Business Week*, April 29, 1991, pp. 70–71.
- Newhouse, Joseph P. "Measuring Medical Prices and Understanding Their Effects," *Rand Paper P-7448*, 1988.
- Office of the Federal Register, National Archives and Records Administration. *Federal Register*, vol. 58 (December 2, 1993), pp. 63864–65. Washington: U.S. Government Printing Office.
- _____. *Federal Register*, vol. 57 (November 25, 1992), pp. 55896–55913. Washington: U.S. Government Printing Office.
- _____. *Federal Register*, vol. 57 (October 7, 1992), pp. 46178–79. Washington: U.S. Government Printing Office.
- _____. *Federal Register*, vol. 57 (July 7, 1992), pp. 29412–13. Washington: U.S. Government Printing Office.

- _____. *Federal Register*, vol. 55 (September 4, 1990), pp. 35990–36080. Washington: U.S. Government Printing Office.
- Reder, Melvin. “Some Problems in the Measurement of Productivity in the Medical Care Industry,” in V. Fuchs, ed., *Production and Productivity in the Service Industries*. New York: Columbia University Press, 1969.
- Scherer, Frederick M. “Pricing, Profits, and Technological Progress in the Pharmaceutical Industry,” *Journal of Economic Perspectives*, vol. 7 (Summer 1993), pp. 97–115.
- Scitovsky, Anne. “An Index of the Cost of Medical Care—A Proposed New Approach,” in Solomon J. Axelrod, ed., *The Economics of Health and Medical Care*. Ann Arbor: Bureau of Public Health Economics, University of Michigan, 1964.
- Trajtenberg, M. “Economic Analysis of Product Innovation: The Case of CT Scanners,” *Harvard Economic Studies*, vol. 160. Cambridge, Mass.: Harvard University Press, 1990.
- Tregarthen, Suzanne. “Statistics Overstate Health Care Costs,” *The Wall Street Journal*, August 18, 1993, editorial page.
- Triplett, Jack E. “The Economic Interpretation of Hedonic Methods,” *Survey of Current Business*, vol. 66 (January 1986), pp. 36–40.
- United States Department of Labor, Bureau of Labor Statistics. *Producer Price Indexes: Data for January 1993*. Washington: Government Printing Office, 1993.
- _____. *BLS Handbook of Methods*. Washington: Government Printing Office, 1992.
- Wallace, William H., and William E. Cullison. *Measuring Price Changes: A Study of the Price Indexes*, 4th ed. Richmond: Federal Reserve Bank of Richmond, 1981.
- Webb, Roy H., and Rob Willemse. “Macroeconomic Price Indexes,” in Roy H. Webb, ed., *Macroeconomic Data: A User’s Guide*, 3d ed. Richmond: Federal Reserve Bank of Richmond, 1994.
- Weisbrod, Burton A. “Productivity and Incentives in the Medical Care Sector,” *Scandinavian Journal of Economics*, vol. 94 (1992), pp. S131–S150.
- Wilensky, Gail R., and Louis F. Rossiter. “Alternative Units of Payment for Physician Services: An Overview of the Issues,” *Medical Care Review*, vol. 43 (Spring 1986), pp. 133–56.