Measuring hospital input price increases: The rebased hospital market basket

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The input prices indexes used in part to set payment rates for Medicare inpatient hospital services in both prospective payment system (PPS) and PPS-excluded hospitals were rebased from 1982 to 1987 beginning with payments for fiscal year 1991. In this article, the issues and evidence used to determine the composition of the revised hospital input price indexes are discussed. One issue is the need for a separate market basket for PPS-excluded hospitals. Also, the payment implications of using hospital-industry versus economywide measures of wage rates as price proxies for the growth in hospital wage rates are addressed.

Introduction

Beginning in fiscal year 1991, increases in input prices for hospital operating costs under the Medicare prospective payment system (PPS) are measured with input price indexes, or market baskets, that have been rebased from 1982 cost weights to 1987 cost weights.[1] For the first time, a separate input price index will be used to measure production cost increases for hospitals that participate in the Medicare program but are excluded from payment under PPS. In addition, important changes were made to the market basket price proxies that are used to measure price changes in hospital inputs for labor.

The decisions made in rebasing and revising the hospital input price indexes have important implications for total Medicare payments to hospitals. Some of the decisions made were controversial and elicited comments and alternative suggestions from the hospital industry and others (*Federal Register*, 1990b). In this article, we present the structural framework for the rebasing effort, describe the issues and questions addressed in the rebasing, and present the analysis and evidence that led to the decisions embodied in the final input price indexes. We also discuss the issues raised by critics and examine the payment implications of alternative input price index structures.

Component parts of hospital expenditures

Spending on hospital care in the United States has grown very rapidly since the Medicare program began in 1966. From 1970 to 1988, for example, there has been nearly an eightfold increase in hospital spending (Office of National Cost Estimates, 1990). The causes of increases in hospital spending have been widely studied. Feldstein has presented persuasive evidence that extensive public and private health insurance has created excess demand for hospital care, which has driven up prices, intensity of services, and expenditures (Feldstein, 1971, 1981).

Other analysts have also pointed out that traditional full-cost reimbursement of hospital care by insurers created an environment in which there were weak incentives to control the growth in costs of producing hospital care (Altman and Eichenholz, 1976). Increasingly sophisticated and expensive technology was also analyzed as a contributing factor (Davis, 1974). Another more subtle influence has been the U.S. system of unrestricted patient choice of physicians and hospitals. This system puts hospitals in a position of competing for doctors and patients on the basis of the quality of their facilities, services, and amenities, rather than on the basis of price (Olson, 1981).

In this environment of multiple causes operating simultaneously to increase hospital expenditures, there was a need to isolate and measure the components of hospital expenditure increases. These components include population, utilization, intensity, and price increases. In particular, as government began to limit the rate of increases, there was a need to separate and measure those parts of expenditure increases that are beyond an individual hospital's ability to control and those parts over which the hospital has some discretion (Freeland and Schendler, 1982).

The hospital input price index, or market basket, is a statistical construct designed to measure the "pure" price increase component of rising hospital expenditures. The hospital input price index measures the change in costs to the hospital for a fixed set of production inputs from a defined base period. The change in prices for that set of inputs over time, when weighted and aggregated, represents the incremental cost to the hospital in a later period to produce the same level and intensity of care with the same mix of inputs as in the base period. This change in the cost of producing care can be measured historically, in the current year, or in a forecasted future year. Because the hospital input price index is fixed-weight, it separates the changes in costs of a known level and type of care from cost increases resulting from changes in the hospital input mix or changes in the volume and intensity of services. It is in this sense that the hospital input price index is a measure of pure price change.

[1] Although the term hospital "market basket" technically refers to the mix of goods and services used to produce hospital care, this term is commonly used to denote the input price index of which the market basket is one part. Accordingly, the term "market basket" in this article refers to the entire input price index.

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Market basket and hospital payment

The Federal Government responded to the rapid increases in Medicare hospital expenditures with cost controls that became progressively more stringent over time. In the 1972 amendments (Public Law 92-603) to Medicare, controls were placed on the rate of growth of the cost of routine (room, board, and nursing) care. These controls were subsequently tightened, but continued to apply only to routine costs, while excluding ancillary services. As hospital expenditures continued to grow at high rates, a national hospital input price index was developed to help set allowable rates of increase (Freeland, Anderson, and Schendler, 1979). The hospital input price index provided a means to measure and forecast the part of increased hospital expenditures that was solely the result of price increases in hospital inputs. The hospital input price index established a reasonable and understandable basis from which to begin the process of prospectively setting allowable increases in hospital costs.

In fiscal year 1983, as a result of Medicare payment reform by Congress (Public Law 97-248), payment controls were extended to include a fixed price for all inpatient hospital operating costs. Payment was to be a fixed price per discharge, rather than on a per diem basis (*Federal Register,* 1982). Congress instituted a more far-reaching Medicare hospital payment reform the following year when it created the prospective payment system (Public Law 98-21). Under PPS, hospitals would be paid a fixed amount per discharge based on the diagnosis-related group (DRG) of the patient (Fetter et al., 1980).[2] Hospitals were now at risk to make profits, break even, or incur losses on their Medicare inpatient hospital business.

The hospital market basket was an integral part of PPS. It was to be used as a major determinant in the annual update of payment rates under PPS (*Federal Register,* 1983). The original hospital market basket used for PPS had 1977 base year weights. In fiscal year 1987, the base year weights were rebased to 1982. For 1991, the base year weights were rebased to the 1987 cost structure of hospitals. In a later section, we examine the implications of rebasing the market basket to 1987 on Medicare payments to hospitals.

Types of price indexes

The hospital input price index is a fixed-weight measure of price inflation. This type of input price index is technically known as a Laspeyres price index (Mansfield, 1975; Gould and Ferguson, 1980). It is designed to answer the question: How much would it cost in the current or a forecasted future period to purchase exactly the same mix of items purchased in the base year?

There are other types of price indexes such as the Paasche and chained types (Wallace and Cullison, 1979). The Paasche index uses current-year quantities as weights. This type of index asks the hypothetical question: How much would it cost in a past period to purchase the same mix of items purchased this year? The primary problem with this type of index in this application is that it does not clearly separate price changes from changes in the quantity of items purchased. It is not possible to clearly identify pure price changes with a Paasche index because year-to-year changes in the quantity of items purchased continually alter the base weights.

A chained-price index successively changes the base year so that the base year for any given period is the previous year. There are two problems with a chained-price index in this application. Obtaining accurate input cost weights for the hospital industry is a difficult endeavor because of long time lags in obtaining some of the hospital cost data. In addition, the continually moving base makes it impossible to get measures of pure price change over more than a 1-year period. In a prospective system, this would mean having not only to forecast price proxies, but also forecasting successive base periods. For these reasons, a Laspeyres index structure was chosen for the hospital input price index. This fixed-weight index is consistent with other government measures of price inflation such as the Consumer Price Index (CPI) and the Producer Price Index.

Structure of the index

There are three main components of the hospital input price index. These components are the cost categories for hospital inputs, the cost weights associated with each hospital input, and the price proxies that measure increases in the price of each cost category. In addition, for a payment system in which prices must be set prospectively (i.e., next year's prices must be established this year), forecasted values of the price proxies are necessary.

Cost categories are created to cover the labor, materials, and supplies that a hospital must purchase in order to produce the operating-cost portion of inpatient hospital care. If PPS payments covered total inpatient hospital costs, there would also have to be cost weights established for capital components. However, currently PPS payments are only for operating costs; consequently, the cost categories in the input price indexes are limited to hospital operating costs.

Cost weights are the numerical share that each cost category contributes to total costs. The cost category weights add to 100 percent of operating costs. Each cost weight can be thought of as that category's share of total operating costs. For the cost categories to accurately represent hospital cost shares, they must be defined to be exhaustive (covering all items that a hospital purchases) and mutually exclusive (clearly delineating categories with no overlap between categories). Under these conditions, the cost weights represent their appropriate cost shares of hospital operating costs.

Price-proxy variables are assigned to each cost category to measure the price change in that category over time. There are several features that a price proxy must have to be appropriately paired with a cost category. First, it

[2]Capital and direct medical education costs continued to be paid based on costs. DRG payments were also adjusted for a number of factors including urban-rural status, teaching status, area wage levels, and outlier status.

must match as closely as possible the content of the cost category whose price changes it is designed to track. It would not make sense, for example, to use a manufacturer's finished-goods price series as a proxy for growth in employee wages. A price proxy must also correspond to the market in which the hospital purchases the item. That is, if the hospital purchases an item at the wholesale or intermediate market, it would not be appropriate to use a retail or final-market price series as the proxy.

Finally, well-known and well-established price series are preferable as proxies. A government price series such as the CPI, for example, is well defined, clearly documented, and has an established record of reliable measurements. An established time series is particularly important when estimates of future price changes are needed to set rates prospectively. The accuracy of econometric forecasts of price changes is greatly enhanced when done from a platform of a long, well-established time series of historical changes in those prices.

Why is rebasing necessary?

Hospital care is efficiently produced under the same set of economic rules and constraints as any other good or service (Gould and Ferguson, 1980; Feldstein, 1979). There are many different combinations of economic inputs that can produce the same quantity and quality of hospital care. Under PPS, hospitals are under greater pressure to combine their operating-cost inputs at minimum cost, because they are facing a predetermined fixed payment per discharge based on the DRG. This means that, as the relative prices of inputs (labor, materials, capital, energy) change, there are economic incentives to substitute the relatively cheaper inputs for the more expensive inputs in order to slow or avoid increases in production costs. This substitution of inputs, of course, must be accomplished within the framework of the existing technology and established health care treatment processes.

For any fixed-weight input price index, it is desirable to periodically examine whether the purchasers (in this case, hospitals) are still purchasing the same items in the market basket in the same proportions as in the base year (Wallace and Cullison, 1979). If hospital input mixes have changed considerably, the input price index must be rebased to reflect the current (or most recent) composition of the inputs being purchased.

Prior to PPS, hospitals were reimbursed for their full reasonable costs of providing health care. This reimbursement system did not contain a strong incentive for hospitals to economize on their costs of producing care (Somers and Somers, 1967; Schultze, 1968; Altman and Eichenholz, 1976). With PPS came pressures on hospitals to control the growth in their costs. This increased the need to monitor changes in the composition of inputs because hospitals would presumably be more explicitly examining the cost and blend of their production inputs.

The hospital market basket was rebased from 1977 cost weights to 1982 cost weights beginning in fiscal year 1987 (*Federal Register*, 1986). The 1982 cost weights did not reflect any changes in the composition of hospital input costs caused by PPS. Beginning in fiscal year 1991, changes in hospital costs under PPS will be measured by hospital input price indexes based on 1987 cost weights (*Federal Register*, 1990a). These input price indexes, defined and analyzed herein, are the first to reflect post-PPS effects on the cost structures of hospitals.

Creating market basket weights

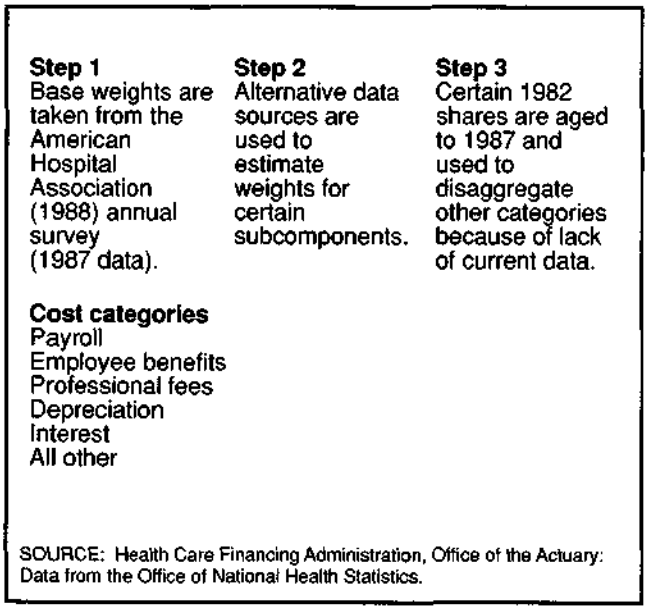
The cost weights for the hospital input price index are derived from hospitals certified to furnish Medicare services. The first issue to be addressed is what data source should be used to get cost weights for hospitals that treat Medicare patients. The Medicare Cost Report (MCR), which must be filed by all hospitals, provides a broad picture of hospital financial operations. However, the primary purpose of the MCR is to make certain that Medicare payments are correct. Because the MCR information is geared primarily to certifying payment as specified by law, it does not contain detailed cost information on all aspects of hospital operation, either for Medicare or the whole hospital. One of the shortcomings for the purposes of the input price index is that it does not contain separate expenditure categories for wages and fringe benefits. Because these components of compensation can grow at different rates over different periods of time, this limits the input price index's ability to measure growth in the separate pieces.

The best source of information on the cost structure of hospitals is the American Hospital Association (AHA) annual survey of its members. The 1988 annual survey (American Hospital Association, 1988), which collected 1987 data for each hospital, was used to create the six main weight categories. These categories include wages and salaries, employee benefits, professional fees, depreciation, interest, and all other costs. Data for Medicare-certified facilities were used. Because capital is not included in PPS payments, depreciation and interest are removed, and the remaining four categories are renormalized to 100 percent of operating costs.

As shown in Figure 1, these AHA weights form the primary cost categories in developing the hospital input price index weights. Other sources of data were employed to provide more detailed cost categories that were not available from the annual survey. For example, as shown in Figure 1, the residual nonlabor "all other" cost categories are broken down into several subcategories. These include separate cost weights for professional liability insurance, energy, food, etc. In the next step, a subcategory such as energy is further broken down into cost weights for fuel and oil, electricity, natural gas, etc. In this process, each new level of subcategories must sum to the cost weight for the aggregate category. That is, professional liability insurance, energy, food, etc., weights must sum to the "all other" total. Similarly, fuel and oil, electricity, natural gas, etc., weights must sum to the energy weight. This process ensures that the main cost weights from the AHA data are always controlling subcategory weights and that cost weights always sum to 100 percent.

Figure 1

Developing input price index weights and cost categories



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Office of National Health Statistics.

Shifts and adjustments are also made in categories where necessary. For example, the cost weight for contract nursing is included in the "all other" AHA cost category but is transferred to the wages and salaries and employee benefits categories in this market basket. Medical fees, which are part of the professional fees AHA cost category, are not included in PPS operating costs. Consequently, they are separated from professional fees and excluded from the market basket.

Additional sources of data

The AHA annual survey included the cost category of utilities only through 1985. The 1987 weight for utilities was created by trending the 1985 cost weight forward using Hospital Administrative Services (HAS) Monitrend data (American Hospital Association, 1982) for utilities from 1985 to 1987. The HAS/Monitrend surveys were also used for the direct service food and pharmaceutical cost weights. The MCR was used to estimate the professional liability insurance (malpractice) cost weight. The remaining weights in the "all other goods and services" category were obtained by aging forward by relative price changes the cost weights for these categories from the 1982 market basket. The expenditure weights were moved from 1982 to 1987 using each category's cumulative relative price increase.

Did the distribution change 1982-87?

After tabulating the 1988 AHA survey data for the main 1987 cost weights, the data were compared with the 1982 cost weights to determine if there had been any

Table 1

Cost weight shares for all Medicare-certified hospitals[1], by year and cost category: United States, 1982 and 1987

Category of costs	Fiscal year 1982	1987	Difference
	Percent		
Total	100.0	100.0	—
Wages and salaries	56.4	53.0	−3.4
Employee benefits	9.7	9.8	0.1
Professional fees, nonmedical[2]	1.8	1.6	−0.2
Other nonpayroll	32.1	35.6	3.5

[1]Includes hospitals under the prospective payment system (PPS) and those excluded from PPS.
[2]Estimated medical professional fees were subtracted by Health Care Financing Administration, Office of the Actuary.

SOURCES: (American Hospital Association, 1983 and 1988); data development by the Health Care Financing Administration, Office of the Actuary, Office of National Health Statistics.

significant redistribution of hospital costs at this level of aggregation. The results are shown in Table 1. The primary shift in cost shares was away from wages and salaries and toward other non-payroll costs. The wage and salary share went down 3.4 percent, nonlabor costs went up 3.5 percent, and employee benefits and nonmedical professional fees remained stable. Later in this article, we examine in more detail how skill-mix changes and the nursing shortage affected the size and composition of hospital payroll expenses between 1982 and 1987.

Are separate market baskets needed?

Hospitals excluded from PPS are primarily long-stay specialty hospitals, including psychiatric hospitals, rehabilitation hospitals, children's hospitals, and other long-stay hospitals. These hospitals continue to be paid based on their reasonable costs as defined and constrained under the 1982 Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) payment reforms. This payment system does not have the same incentives for hospital efficiency that apply under PPS (Langenbrunner et al., 1989).

Since the beginning of PPS, excluded hospital payments per case had been updated for inflation each year using the same regulation hospital input price index that was used to update PPS payment rates. The Prospective Payment Assessment Commission (ProPAC) has been recommending for some years that a separate update mechanism be developed for excluded hospitals. The commission's argument, in brief, is that: "The types of patients seen and the treatment they receive vary significantly between PPS and excluded hospitals" (Prospective Payment Assessment Commission, 1986). To begin analyzing this question, we examined whether PPS and excluded hospitals had similar basic cost structures in 1987.

In Table 2, the basic cost shares are shown for all hospitals, both PPS and excluded, in 1987. When PPS and exempt hospitals are split, it is apparent that they have very different cost structures. Wages, salaries, and fringe benefits represent 62 percent of total operating

Table 2

Cost weight shares for Medicare-certified hospitals, by type of hospital and cost category: United States, 1987

Category of costs	All hospitals	Hospitals under PPS[1]	Hospitals excluded from PPS
Total	100.0	100.0	100.0
Wages and salaries	53.0	52.2	61.4
Employee benefits	9.8	9.5	13.0
Professional fees, nonmedical[2]	1.6	1.7	1.3
Other nonpayroll	35.6	36.6	24.3

[1] PPS is prospective payment system.
[2] Estimated medical professional fees were subtracted by the Health Care Financing Administration, Office of the Actuary.

SOURCE: (American Hospital Association, 1988); data development by the Health Care Financing Administration, Office of the Actuary, Office of National Health Statistics.

costs in PPS hospitals. These components make up a much larger share (74 percent) of excluded hospitals' costs. It is clear that excluded hospitals use a much higher proportion of labor inputs on average, i.e., they are more labor-intensive than the short-term hospitals covered under PPS. This probably reflects the human-service oriented modes of treatment used for psychiatric (e.g., psychotherapy) and rehabilitation (e.g., physical therapy) conditions. PPS hospitals may rely more on supplies, procedures, and processes related to technology such as surgery and diagnostic imaging equipment.

Do cost structures affect indexes?

The fact that the labor share of inputs is higher in excluded hospitals has been known for some time (Prospective Payment Assessment Commission, 1986). Representatives from the excluded hospitals have cited this labor-share difference in requesting that a separate input price index be established for excluded hospitals (Kelly, 1990). However, the labor-share difference does not necessarily mean that a separate input price index is needed to accurately measure excluded hospital cost increases. This argument confuses differences in the composition of hospital costs with differences in the growth of hospital input prices. In Table 3 and Figure 2, we show comparisons of historical annual increases in input prices for excluded hospitals and PPS hospitals for the period 1977 to 1989. These annual increases are very similar and do not vary by more than 0.2 percent in any year from 1984 to 1989. This shows that updating excluded hospitals' payment rates using the PPS input price indexes did not favor or disadvantage excluded hospitals in this period.

If the labor cost structure differs so much between excluded and PPS hospitals, why were the annual increases in costs so similar? This occurred because the rate of growth in labor and nonlabor cost categories, as measured by the input price index price proxies, was similar during that period. To restate, because labor costs and nonlabor costs were growing at roughly the same rate during this period, the differences in the labor shares did not substantially affect the growth in total costs. Nevertheless, because there is no guarantee that labor and nonlabor shares will continue to grow at the same rate in the future, the decision was made to create a separate input price index for excluded hospitals beginning in 1991. This action acknowledges the difference between PPS and excluded hospitals' labor cost shares. The separate input price index for excluded hospitals also acknowledges the possibility that labor and nonlabor costs may grow at different rates in the future, causing cost increases in PPS and excluded hospitals to diverge more than they have historically.

Is the rebasing revenue-neutral?

One of the most important issues when an input price index is rebased is whether the new base changes the historical and forecasted annual increases. A change in forecasted annual increases in the hospital input price index means a change in aggregate payments to hospitals. A rebasing is designed to update cost weights to a more current period. Why would rebasing change forecasted values of annual increases? The basic reason is that alternative base-year cost weights imply different mixes of inputs. If prices of the various inputs are escalating at different rates, the composite increases measured with old base-year weights and new base-year weights can vary.

In an input price index, the base-year weights are constant, but the relative importance of the various cost categories changes as a result of relative price changes.

Table 3

Annual percent changes in input price indexes for hospitals under the prospective payment system (PPS) and those excluded from PPS, by year and type of hospital: United States, 1977-89

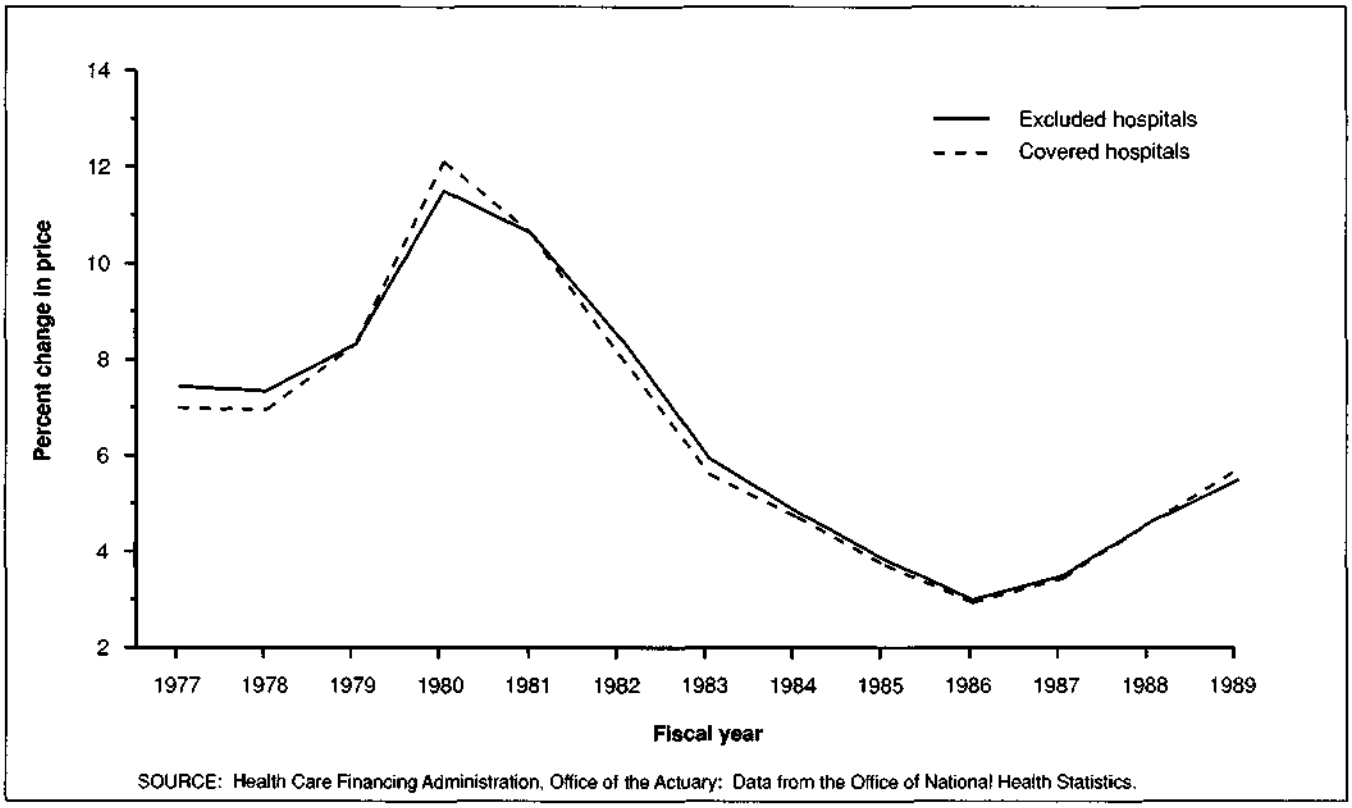
Hospital type	Federal fiscal year													Average
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1977-89
Hospitals excluded from PPS	7.4	7.3	8.3	11.5	10.6	8.5	5.9	4.8	3.8	3.0	3.5	4.6	5.5	6.5
Hospitals under PPS	7.0	6.9	8.3	12.1	10.6	8.1	5.6	4.7	3.7	2.9	3.4	4.6	5.7	6.4
Differences	0.4	0.4	0.0	–0.6	0.0	0.4	0.3	0.1	0.1	0.1	0.1	0.0	–0.2	0.1

NOTES: In this sensitivity analysis, 1987 weights for hospitals under PPS and excluded from PPS are used. The wage and price proxies used are from the 1982-based regulation market basket because these proxies are available for long-run analysis. The wage and price proxies were used through September 30, 1990, for the Medicare inflation adjustment. The price proxies proposed by the Health Care Financing Administration, and by the Prospective Payment Assessment Commission in their March 1, 1990 report, incorporated a newly available employment cost index for hospital workers (beginning 1986, second quarter). Thus a long-run historical analysis cannot be done using the proposed price proxies.

SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Office of National Health Statistics.

Figure 2

Percent change in input prices for hospitals covered by or excluded from the prospective payment system: United States, 1977-89



SOURCE: Health Care Financing Administration, Office of the Actuary: Data from the Office of National Health Statistics.

Table 4

Hypothetical example of potential effects of rebased weights on payments

Cost category	Year 1 base weights	Year 1 to 5 cumulative price increases	Year 5[1] relative importance	Year 5 rebased weights	Year 6 forecasted price increases	Year 6 total annual increase: From year 1 based weights	Year 6 total annual increase: From year 5 rebased weights
Wages	60	50	64.3	55	10	8.2	7.8
All other	40	25	35.7	45	5		

[1]The calculation of relative importance factors for year 5 is done as follows:

Base weights		Cumulative price increase factors		Products and sum	Relative importance factors
60	×	1.50	=	90	90/140 = .643
40	×	1.25	=	50	50/140 = .357
100				140	

SOURCE: Health Care Financing Administration, Office of the Actuary, Office of National Health Statistics.

This point is illustrated in Table 4. In this simplified example, there are two inputs: wages and all other costs. We assume unrealistically for purposes of exposition that wages grew twice as fast as all other costs from year 1 to year 5. This process changed the year 1 base weights from 60 percent wages and 40 percent all other costs to year 5 relative importances of 64.3 percent and 35.7 percent. If wages were actually growing twice as fast as other costs during this period, hospitals would have had an incentive to substitute nonlabor inputs for labor inputs. Assuming for purposes of demonstration that inputs were more substitutable than they actually are, hospitals in the example substituted large quantities of nonlabor inputs to economize on labor costs. When the weights were actually rebased in year 5, this substitution was reflected in the new cost weights: 55 percent labor costs and 45 percent all other costs. This new labor share is much lower than the year 1 base weights (60 percent) and the year 5 relative importances (64.3 percent).

How does the difference in the new rebased weights and the rolled-forward relative importances affect hospitals? As shown in Table 4, if year-6 costs were

forecasted to increase the same way they had over the previous years, with wages growing twice as fast as all other costs, there would be a difference in prospectively set payment levels in year 6. Using the year-1 base costs, rolling the costs forward to year 5, and applying the year-6 forecast would result in an 8.2-percent increase in payment rates. Using the new year-5 rebased weights and the identical year-6 forecast would result in a 7.8-percent increase in payment rates. The example could have been structured to reverse the outcomes, and the relative price and input substitution assumptions are not realistic. However, the example shows clearly how rebasing an input price index can lead to different forecasts of future price increases than choosing to retain "old" cost weights.

Rebasing's effect on hospital payments

In light of the theoretical possibility that rebasing could affect total payments, we analyzed the effect of rebasing the hospital input price index to 1987 on measured increases in hospital input costs. In Table 5, historical and forecasted annual percent increases in the 1982 regulation (PPS and excluded) input price index and the 1987 base PPS input price index are shown. The 1982 price proxies are used with both base years in the first two lines in the table. This comparison is made to determine if annual increases differ solely because of the use of rebased weights. The 1987 PPS input price indexes are also shown in Table 5 with the 1987 price proxies for 1988-91. This allows for a comparison of the combined effect of changes in 1987 weights and price proxies.

The 1982 base regulation input price index and the 1987 base PPS input price index with 1982 price proxies track each other closely over time. The annual percent changes are within 0.4 percent of each other for each year from 1982 to 1991. The most important year is 1991 because this was used to update PPS prospective payment rates. The new input price index with 1987 weights and 1987 price proxies produced the identical 1991 forecast (5.2 percent) as when 1982 weights and 1982 price proxies were used. This table confirms that rebasing to 1987 cost weights for PPS hospitals was essentially revenue-neutral, i.e., it would not have added or subtracted any significant amount from total PPS hospital payments over the last 10 years. The 0.2-percent level of difference in the 1982- (5.2 percent) and 1987- (5.0 percent) based input price indexes for 1991 is well within normal forecast error limits.

Hospital occupational mix change

PPS changed hospital incentives to encourage more efficient use of resources. As shown in Table 2, hospitals are labor-intensive producers of hospital care. More than 60 percent of PPS hospital input costs and nearly 75 percent of excluded hospital costs are direct payments to labor in the form of wages and fringe benefits. As hospitals adjusted to PPS, it is reasonable to expect that there may have been changes in the mix of employees hired.

As part of an improved methodology, we used different data sources for hospital occupational mix in 1982 and 1987. The 1980 Bureau of the Census (1984) data had to be aged forward to get 1982 wage shares for all hospital workers. The Current Population Survey (U.S. Department of Commerce, 1989), which we feel more closely reflects the skill mix used in acute care hospitals covered by PPS, was used to get 1987 data for private hospitals. In Table 6, the differences between the 1987 and 1982 occupational shares are documented.

Professional and technical employees were the largest occupational component in 1982, making up 57.2 percent of all hospital payroll. Service workers and clerical employees made up 18.7 percent and 12.5 percent, respectively, of the 1982 hospital payroll shares. From 1982 to 1987, there was a clear shift toward professional and technical employees and away from service workers. Professional and technical payroll shares increased to 62.1 percent of total hospital payroll in 1987. There was also an increase in management and administration payroll shares, from 7.3 percent to 9.7 percent. The largest shift from 1982 to 1987 was the 6.5-percent drop of the share in hospital service workers. We analyze hospital skill-mix shifts in more detail later.

Table 5

Comparison of annual percent increases of simulated 1982- and 1987-based input price indexes: 1982-91

	Federal fiscal years									
	Historical								Forecasted	
Weights	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1982 regulation input price index weights with 1982 price proxies	8.3	5.9	4.9	3.9	3.1	3.6	4.8	5.4	4.6	5.2
1987 PPS cost weights with 1982 price proxies	8.1	5.5	4.7	3.7	2.8	3.4	4.8	5.4	4.4	5.0
1987 PPS cost weights with 1987 price proxies	NA	NA	NA	NA	NA	NA	4.7	5.6	4.8	5.2

NOTE: PPS is prospective payment system. NA is not available.

SOURCES: Health Care Financing Administration, Office of the Actuary: Data from the Office of the National Health Statistics; (DRI/McGraw-Hill, 1990).

Table 6

Health Care Financing Administration occupational index weights: United States, 1982 and 1987[1]

Occupational category	Base year 1982[2]	1987[3]
Total	100.0	100.0
Professional and technical	57.2	62.1
Managers and administration	7.3	9.7
Sales	0.3	0.4
Clerical	12.5	12.9
Craft and kindred	2.5	1.9
Nontransport operatives	1.0	0.6
Transport equipment operatives	0.3	0.1
Nonfarm laborers	0.2	0.1
Service workers	18.7	12.2

[1] Differences reflect shifts in employment and relative wages as well as changes in methodology.
[2] 1980 decennial census data aged to 1982.
[3] 1987 Current Population Survey weights for private hospitals.

SOURCES: U.S. Department of Commerce, Bureau of the Census, 1980 Decennial Census; U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey, 1987; data development by Health Care Financing Administration, Office of the Actuary, Office of National Health Statistics.

Hospital response to nursing shortage

There was strong evidence of a shortage of registered nurses in the late 1980s (U.S. Department of Health and Human Services, 1988; Coffey et al., 1988). This shortage was primarily the result of strong demand for nurses rather than a cyclical shortage of nurses. The supply of nurses and labor force participation rates of nurses were at very high levels in historical terms when the shortage was most acute (Wilensky, 1988). Because nurses are such an important part of the labor supply, we examined the effects of the nursing shortage on nursing wage rates.

An occupational shortage causes wages in the shortage category to grow relatively faster than occupations that are not in short supply. To determine how the shortage affected nursing wages, we analyzed data from a University of Texas (1989) survey that collects salary information for nurses and other health occupations. The survey consists of hospitals and medical institutions that participate voluntarily, and the sampled institutions can vary from year to year (Donham, Maple, and Singer, 1990). In Table 7, the annual percent increase in starting and maximum salaries for registered nurses between 1981 and 1989 is shown. For comparison, we also show two measures of growth in hourly earnings for all hospital industry workers and for professional and technical workers economywide.

In general, the maximum wage rate for nurses grew faster than the starting rate from 1981 to 1989. This expanded the wage differentials between the starting salaries for new nurses and the salaries of more experienced nurses. A narrow career wage and salary band that caused nurses to "top out" very early in their careers has been identified as one of the less desirable features of nursing as a profession (U.S. Department of Health and Human Services, 1988). In the early 1980s, increases in nurses' maximum rates were below the increases for all hospital workers, and in some years were below the increases for professional and technical workers in the general economy. In 1988 and 1989, by contrast, the maximum wage and salary rate for nurses increased 10.6 percent and 9.9 percent, respectively. These increases more than doubled the rates of increase of professional and technical employees economywide in those years. The increases in the maximum rate for registered nurses in 1988 and 1989 were also well above the average increases for all hospital workers.

The University of Texas data show that hospitals responded to the nursing shortage by increasing registered nurses' wages and salaries, particularly the top pay rates for experienced nurses. Unfortunately, data are not available to show how many nurses benefited by this expansion in top salaries or how the distribution of nurses changed across the expanded salary band.

Effect of the nursing shortage

The shortage of nurses meant that hospitals had to pay higher wages for this critical resource input. Other things being equal, one would surmise that the hospital input price index would show larger increases in hospital input costs. In Tables 3 and 5, it can be seen that, for various configurations of bases and weights, the annual increases in the input price index were considerably higher in 1988

Table 7

Percent change of wages and salaries of registered nurses compared with hourly earnings of private hospital workers and professional-technical employees: United States, 1980-89

Year	Registered nurses: Starting rate	Registered nurses: Maximum rate	Average hourly earnings[1]: Private hospital workers	Employment cost index[1,2]: Private hospital workers	Employment cost index[1,2]: Professional and technical workers
1980	—	—	—	—	—
1981	12.3	13.9	13.3	—	10.5
1982	9.3	10.5	11.2	—	8.6
1983	2.9	4.6	7.4	—	6.5
1984	3.8	3.8	5.3	—	5.8
1985	3.6	5.3	5.2	—	4.1
1986	4.6	4.3	4.0	—	3.7
1987	3.1	4.8	5.2	5.1	4.2
1988	6.9	10.6	6.8	5.4	4.5
1989	4.8	9.9	6.6	6.1	4.7

[1] Data from third quarter of each year.
[2] Includes wages and salaries only.

SOURCES: (University of Texas, 1989); data development by the Health Care Financing Administration, Office of the Actuary, Office of National Health Statistics.

Table 8

Percent shares of hours worked[1] in the hospital industry, by occupation and type of hospital: United States, 1980-89

Occupation and type of hospital	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Percent change[2]
All hospitals					Percent						
All occupations	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Registered nurses	21.3	21.0	21.2	21.5	22.3	23.2	23.3	24.4	23.1	22.8	+2.3
Licensed practical nurses	5.5	5.1	5.2	6.2	5.3	5.0	5.0	4.6	4.3	4.3	−0.9
Technicians	8.4	9.5	9.2	9.0	9.5	10.1	9.3	8.7	10.0	9.9	+0.5
Therapists	2.5	3.1	2.8	2.9	3.0	3.1	3.1	3.0	3.0	3.2	+0.2
Nursing aides	12.1	11.3	10.8	10.8	8.8	8.7	8.9	8.4	9.0	8.4	−2.8
Other health occupations	9.3	9.5	10.3	10.8	10.9	10.6	10.2	10.0	10.4	10.8	+0.7
Nonhealth occupations	41.0	40.6	40.5	38.8	40.3	39.5	40.2	40.9	40.3	40.6	−0.1
Private hospitals											
All occupations	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Registered nurses	23.5	22.8	23.1	23.1	24.4	24.6	24.6	26.6	24.8	24.7	+2.3
Licensed practical nurses	5.7	5.6	5.8	6.4	4.9	4.9	4.9	4.7	4.2	4.3	−1.3
Technicians	9.1	10.7	10.1	9.5	10.6	10.7	9.8	9.0	10.4	10.4	−0.1
Therapists	2.6	3.0	2.8	2.8	3.0	3.4	3.3	3.1	3.2	3.1	+0.3
Nursing aides	10.1	9.9	9.4	9.3	7.3	7.7	7.6	7.5	8.0	7.6	−2.1
Other health occupations	8.7	8.6	9.5	10.8	10.0	9.5	9.4	9.1	9.2	9.4	+0.4
Nonhealth occupations	40.3	39.4	39.4	38.1	39.6	39.3	40.4	40.1	40.0	40.4	+0.4

[1]Percent of total hours worked.
[2]1987-to-1989 average less 1980-to-1982 average.

NOTE: Column values may not sum to 100 percent because of rounding.

SOURCES: U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey; data development by Health Care Financing Administration, Office of the Actuary, Office of National Health Statistics.

and 1989 than in 1986 and 1987. The additional extra wage costs associated with the nursing shortage had some effect on these increases.

We did further occupational analysis to understand how the increased demand for registered nurses was affecting increases in hospital costs. We found that hospitals made a fundamental shift in their skill mixes of professional and technical employees in the 1980s. In Table 8, data are shown from the Current Population Survey (U.S. Department of Commerce, 1989) on the shares of hospital employees within the professional and technical occupational category for all hospitals from 1980 to 1989. We believe this table is a better gauge of hospital skill-mix shifts than Table 6 because it does not mix all hospitals with private hospitals and does not switch from Bureau of the Census decennial data to Current Population Survey data.

The registered nurses' share of hospital professional and technical employees increased from 21.3 percent in 1980 to 22.8 percent in 1989. At the same time, the share of lesser skilled nursing personnel dropped. The share of licensed practical nurses dropped from 5.5 percent in 1980 to 4.3 percent in 1989. Nursing aides' share dropped even more sharply, from 12.1 percent in 1980 to 8.4 percent in 1989. Thus, at the same time, hospitals were hiring more registered nurses and paying them higher salaries, while they were saving on their wage bill by removing licensed practical nurses and nursing aides from their payroll. Using a Laspeyres fixed-weight index and holding other things equal, we calculated that the net effect of these offsetting skill-mix shifts was to add between 1 and 2 percent to the hospital wage bill in the 1980s (Donham, Maple, and Lemieux, 1990).

Internal versus external price proxies

Because hospitals are labor-intensive producers, the proxy variables chosen to measure the growth in wage and benefit costs are the most significant in determining the growth in hospital input costs. The most basic choice is whether the wage and benefit proxy variables should be "internal" or "external." Internal wage and benefit proxy variables measure growth in wages of employees working in the hospital industry. External wage and benefit proxy variables measure growth in wages and benefits of employees working in broad occupational groupings in the general economy. Hospital industry employees are only reflected to the extent that they are part of the economywide category.

There is a continuing debate about whether internal employee compensation proxies or external employee compensation proxies are more appropriate to measure the growth in employee compensation in an input price index that is to measure the prudent purchase of inputs. Using 100-percent internal (hospital-industry) measures of employee compensation growth would effectively pass through, as reimbursable costs, the higher rates of employee compensation growth that have been experienced by hospitals compared with the rest of the economy. Using 100-percent external (economywide) measures of employee compensation growth would effectively hold hospitals to the lower levels of employee compensation growth in the larger economy for broad occupational categories.

In the 1982-based input price indexes, the wage proxies blended both internal and external wage and fringe proxies, but were predominantly weighted to external measures of wage growth. The decision to

Table 9

Simulated effects of various wage and employee benefit price proxies on annual percent increases in input price indexes (1987 weights)

Alternative formulation of index	Federal fiscal years			
	Historical		Forecasted	
	1988	1989	1990	1991
HCFA PPS input price index	4.7	5.6	4.8	5.2
Wages:				
Professional and technical (50 percent ECI for hospital, 50 percent ECI for professional and technical)				
Other (economywide occupational ECIs)				
Benefits:				
Professional and technical (50 percent ECI for hospital, 50 percent ECI for professional and technical)				
Other (economywide occupational ECIs)				
ProPAC-proposed PPS input price index	4.9	5.8	5.0	5.4
Wages:				
Professional and technical (50 percent ECI for hospital, 50 percent ECI for professional and technical)				
Other (50 percent ECI for hospital, 50 percent economywide occupational ECIs)				
Benefits:				
Professional and technical (50 percent ECI for hospital, 50 percent ECI for professional and technical)				
Other (50 percent ECI for hospital, 50 percent ECI economywide occupational ECIs)				
100 percent economywide wages and employee benefits	4.6	5.2	4.5	5.1
Wages:				
Professional and technical (100 percent ECI for professional and technical)				
Other (economywide occupational ECIs)				
Benefits:				
Professional and technical (economywide occupational ECIs)				
Other (economywide occupational ECIs)				
100 percent hospital industry wages and employee benefits	5.2	6.3	5.4	5.7
Wages:				
Professional and technical (ECI for hospital)				
Other (ECI for hospital)				
Benefits:				
Professional and technical (ECI for hospital)				
Other (ECI for hospital)				
Addendum				
HCFA regulatory input price index (composite of PPS and excluded hospitals), using 1982 weights	4.8	5.4	4.6	5.2
Wages:				
Professional and technical (50 percent AHE for hospital industry, 50 percent ECI for professional and technical)				
Other (economywide occupational ECIs)				
Benefits:				
Professional and technical (economywide employee benefits per worker)				
Other (economywide employee benefits per worker)				

NOTES: HCFA is Health Care Financing Administration. PPS is prospective payment system. ECI is employment cost index. AHE is average hourly earnings. ProPAC is Prospective Payment Assessment Commission.

SOURCES: Health Care Financing Administration, Office of the Actuary, Office of National Health Statistics; (DRI/McGraw-Hill, 1990).

depend more heavily on external measures of compensation growth was based in part on the philosophy of PPS. PPS eliminated full-cost reimbursement of hospital operating costs and substituted financial incentives for prudent purchasing of hospital inputs. The PPS input price index was designed to measure the growth in hospital prices for the efficient use of production inputs. It is structured to encourage cost-effective spending for labor by using economywide employee compensation proxy variables in those occupations that are generally employed both in and out of hospitals. This includes managers and administrators, sales workers, clerical workers, etc. Hospitals receive full credit for increases in employee compensation in these occupations at the rate this growth occurs in the general economy.

However, the PPS input price index has also traditionally recognized that there are specialized occupations, such as registered nurses, where shortages can cause employee compensation to grow faster than in the broader occupational category in the general economy. These occupations are primarily in the professional and technical component of hospital employee compensation. This component is the largest occupational category in the hospital. To compensate hospitals for increases in employee compensation among professional and technical staff that may result from shortages or other circumstances outside the hospital's management control, a hospital industry employee compensation proxy equal to one-half of the professional and technical component was used. This employee compensation price proxy structure passes through one-half of any increases in hospital industry employee compensation for professional and technical employees in excess of general employee compensation inflation. It was constructed this way to recognize that hospitals may

experience above-average employee compensation increases for registered nurses or other specialized professional and technical staff, while retaining incentives for the efficient use of labor.

To determine the appropriate internal-external mix of wage-proxy variables, we conducted sensitivity analyses to examine the effects of different proxy variables on annual increases in the PPS input price index. In Table 9, the annual percent change in the 1987 base hospital input price index for 1988 to 1991 is shown, using four different wage and salary proxy variables. The 1982 base input price index and 1982 wage price proxies are also included in the table. The five configurations of wage and salary proxy variables simulate the effects of a wide variety of policy options.

The first wage proxy configuration continues the 50-50 internal-external split only on professional and technical wages but substitutes a different internal wage proxy than that used for the 1982 base input price index. The second proxy is a ProPAC proposal that would provide a 50-50 internal-external split of all wage proxies on all occupations (Prospective Payment Assessment Commission, 1990). The third proxy is a 100-percent external wage proxy that shows the effect of holding hospital wage increases to the levels that occur in the general economy. The fourth proxy is a 100-percent internal wage proxy that shows the effects of passing through hospital wage increases as they occur. The last wage proxy is the 1982 internal-external blend, which shows the effect of continuing current policy without rebasing.

In Table 9, it can be seen that there is relatively little difference in the annual percent change for 1991 using the five wage proxies. The highest 1991 forecasted increase is for the total internal wage proxy, 5.7 percent. This configuration applies the Employment Cost Index (ECI) (U.S. Department of Labor, 1990) for hospital workers to both wages and fringes. The lowest forecasted increase is for the total external wage proxy, 5.1 percent. This proxy applies the economywide ECI, weighted by the occupational mix of the hospital, to both wages and fringes. The 1982 wage proxy configuration produces a simulated increase between the internal and external proxies, 5.2 percent. This wage proxy uses the average hourly earnings (AHE) of hospital workers as the internal wage proxy in its blend. The ProPAC 50-50 internal-external blend applied to all occupations was forecasted to increase 5.4 percent. This was very close to the Health Care Financing Administration (HCFA) 50-50 internal-external blend applied only to professional and technical employees that was forecasted to increase 5.2 percent. The decision was made to adopt the HCFA internal-external wage blend in the 1987-based input price index. There was very little difference in the projected payments using the various feasible wage proxy options. This wage proxy is also consistent with the philosophy of PPS in holding hospitals more closely to future wage and salary increases in the general economy.

Final configuration of the indexes

In Table 10, the final cost weights for the PPS and excluded hospital input price indexes rebased to 1987 can be seen. The wage and price proxies are identical for both input price indexes and are described in detail elsewhere (*Federal Register*, 1990a, 1990b). The main changes in the 1987-based input price index were in the wages and salaries and fringe benefits price proxies. The internal wage and salary price proxy in the 1982-based input price index was the AHE for hospital workers. One problem with this proxy is that, because it is determined by dividing total hours worked by total wages and salaries, it does not control for changes in the skill mix over time. As previously shown, there were changes in the hospital professional and technical skill mix in the 1980s. To replace the hospital AHE, we substituted the hospital ECI. This proxy provides a purer measure of wage and salary increases for hospital workers, holding skill mix constant. For fringe benefits, the 1982 price proxy was employer contributions for social insurance and other labor income per worker. This variable was replaced by the ECI for employee benefits, using the same blend as for wages and salaries, in the 1987 input price index. This proxy variable is better defined than the previous variable and is consistent with the ECI used for wages and salaries. The 1987 occupational cost weights and the price proxies used to measure increases in wages and benefits for the PPS input price index are shown in Table 11.

Table 10

Comparison of 1987 weights for hospitals under the prospective payment system (PPS) and those excluded from PPS: United States, 1987

Expense categories	Excluded hospitals	PPS hospitals
Wages and salaries	61.3	52.2
Employee benefits	13.0	9.5
Other professional fees	1.4	1.7
Energy and utilities	2.8	2.4
Fuel, oil, coal, and other fuel	0.7	0.6
Electricity	1.3	1.1
Natural gas	0.4	0.3
Motor gasoline	0.3	0.2
Water and sewerage	(1)	(1)
Professional liability insurance	1.0	1.4
All other	20.6	32.8
All other products	13.8	21.8
Pharmaceuticals	1.6	3.9
Food	3.3	3.3
Direct purchase	2.5	2.1
Contract service	0.7	1.2
Chemicals	1.9	3.1
Medical instruction	1.6	2.7
Photographic supplies	1.6	2.6
Rubber and plastics	1.4	2.3
Paper products	0.9	1.4
Apparel	0.7	1.1
Machinery and equipment	0.3	0.5
Miscellaneous products	0.5	0.8
All other services	6.9	11.0
Business services	2.4	3.8
Computer services	1.2	2.0
Transportation and shipping	0.8	1.2
Telephone	0.6	1.0
Blood services	0.4	0.6
Postage	0.2	0.4
All other services (labor-intensive)	0.8	1.2
All other services (non-labor-intensive)	0.5	0.8

[1]Rounds to less than 0.1 percent.

SOURCE: Health Care Financing Administration, Office of the Actuary, Office of National Health Statistics.

Table 11

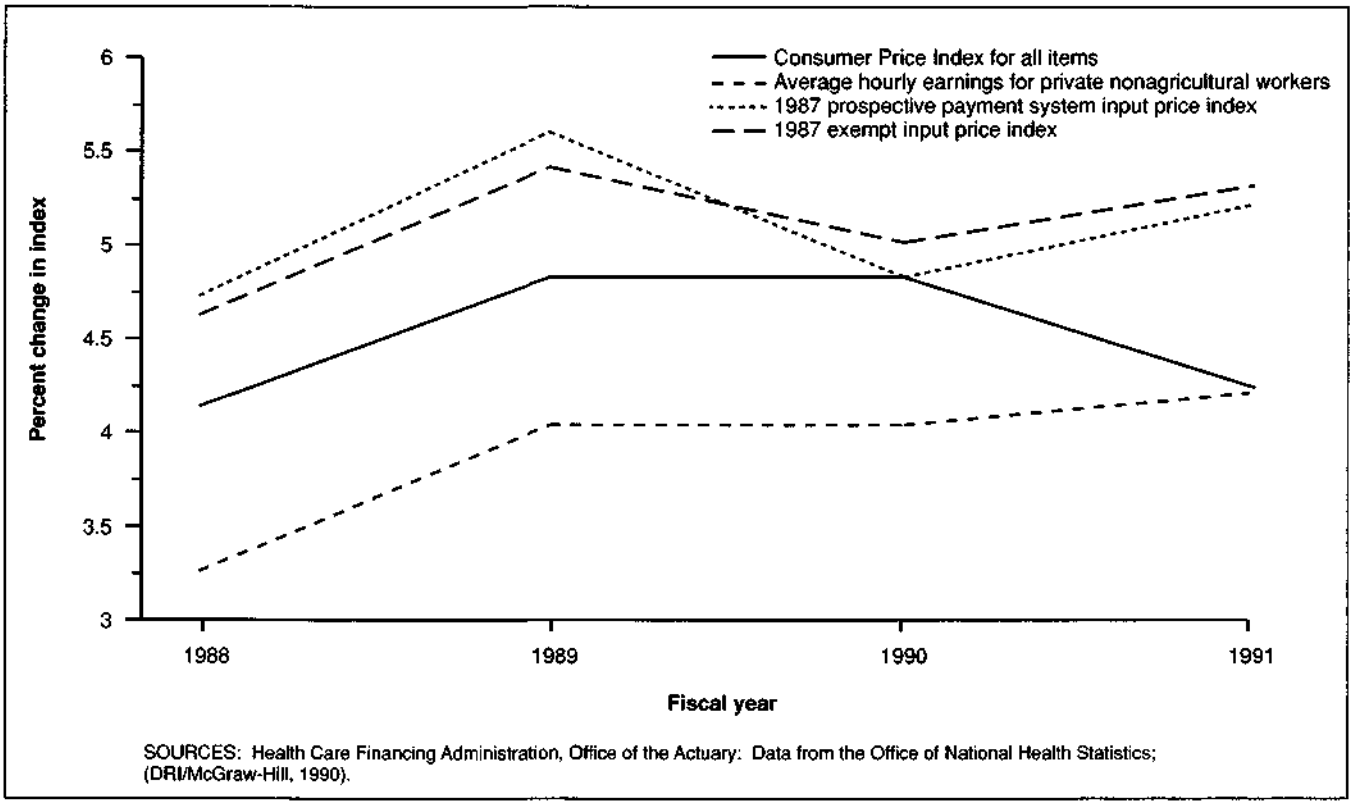
Blended wages and salaries component of the 1987 input price index

Occupational category	Wages and salaries percentage	Price proxy
Total wages and salaries	100.0	Total weight for wages and salaries is 52.2
Professional and technical	62.0	50-50 blend of Employment Cost Index for hospital workers and Employment Cost Index for wages and salaries of professional specialty and technical workers
Managers and administrators	9.7	Employment Cost Index for wages and salaries for executive, administrative, and managerial workers
Sales	0.4	Employment Cost Index for wages and salaries for sales workers
Clerical workers	12.9	Employment Cost Index for wages and salaries for administrative support including clerical workers
Craft and kindred	1.9	Employment Cost Index for wages and salaries for precision production, craft, and repair workers
Operatives except transport	0.6	Employment Cost Index for wages and salaries for machine operators, assemblers, and inspectors
Transport equipment operatives	0.1	Employment Cost Index for wages and salaries for transportation and material-moving workers
Nonfarm laborers	0.1	Employment Cost Index for wages and salaries for handlers, equipment cleaners, helpers, and laborers
Service workers	12.3	Employment Cost Index for wages and salaries for service occupations

SOURCES: U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey, 1987; data development by Health Care Financing Administration, Office of the Actuary, Office of National Health Statistics.

Figure 3

Percent change in the 1987-based prospective payment system (PPS) and exempt input price indexes, Consumer Price Index for all items, and average hourly earnings



SOURCES: Health Care Financing Administration, Office of the Actuary: Data from the Office of National Health Statistics; (DRI/McGraw-Hill, 1990).

In Figure 3, one can see a comparison of the 1988-91 rates of growth of the 1987-based PPS and excluded hospital input price indexes compared with two general measures of inflation, the CPI and AHE. The hospital input price indexes generally have higher annual rates of growth than the general measures of inflation in these years.

Summary

The input price indexes used in part to set prospective payments to PPS and excluded hospitals were rebased from 1982 to 1987 beginning with payments for fiscal year 1991. A separate input price index was created for the first time for excluded hospitals. These hospitals'

production costs are more heavily weighted to direct labor payments than are those of PPS hospitals. Although these differences in cost structure do not appear to have historically worked to the disadvantage of excluded hospitals, a new market basket was created to ensure that future payments to these hospitals would be based on their decidedly different cost structure.

There were shifts in hospital employment mix between 1982 and 1987. In general, hospitals hired more professional, technical, management, and administrative personnel. At the same time, the share of service personnel dropped. Within the professional and technical category, hospitals hired more registered nurses and fewer licensed practical nurses and nursing aides. This increased hiring of registered nurses in hospitals contributed to a shortage of nurses in the late 1980s. This shortage of registered nurses caused nursing wages and salaries in the hospital to increase and contributed to higher market basket increases in 1988 and 1989.

An important issue in the rebasing was which type of price proxy to apply to hospital wages. An internal (to the hospital industry) price proxy would permit average hospital wages to increase at the level at which they actually increased. An external (economywide) price proxy would hold hospitals to wage increases occurring in the rest of the economy for broad occupations. The decision was to use a blend of internal and external price proxies for hospital wages and employee benefits. The blend was primarily weighted to external measures of wage increases, but it allows one-half of the professional and technical employees (including nurses and other specialized personnel) wage increases to be weighted by hospital worker wage and salary increases. Analyses were undertaken to examine whether the rebased input price indexes were revenue-neutral, that is, did not add to or subtract from total Medicare payments to hospitals. These analyses showed that the rebasing and revising of the input price index were essentially revenue-neutral.

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