Does one national prospective payment system market basket make sense?

by Jerry Cromwell

For the first 4 years of Medicare's prospective payment system (PPS), one national market basket of cost weights and price proxies has been used to update payment rates. Previous evidence for a single rate is reviewed, and more recent data are presented that show definite regional differences in input price inflation, resulting in systematic gains or losses for some regions. However, as long as the Health Care Financing Administration continues to periodically update its hospital wage index, the net impact on hospitals is minor. Nevertheless, large differences in PPS-excluded hospital cost shares indicate the need for two sets of cost weights.

Introduction

Throughout the Medicare prospective payment system (PPS) transition period, the Health Care Financing Administration (HCFA) has used a single market basket to update payment rates. No distinction has been made for systematically different cost shares or price proxies, either by region of the country or by hospital type. This is true even of the PPS-exempt Tax Equity and Fiscal Responsibility Act (TEFRA) hospitals (e.g., psychiatric and rehabilitation hospitals). HCFA used a single market basket, based on previous research by Freeland, Schendler, and Anderson (1981), that found no statistically significant effect on the update factor of using regional cost weights. One explanation for the null finding is that several of the price proxies had no regional forecast. Another explanation may be the limited differences in interregional inflation trends during the 1970's, differences that may be greater in the 1980's. A third explanation may be the limited number of cost shares used (18), with only a single wage share.

The purpose of this article is to update the earlier HCFA work in three ways. First, using American Hospital Association (AHA) data, a finer breakdown of the wages and salaries share, among other things, is used. Second, more regional variation in selected price proxies is incorporated. And third, the 1984 AHA annual survey data tape is used to estimate the basic cost weights, updating the shares from 1977. Although HCFA currently has an understanding with AHA not to use any of the AHA data for the purpose of updating rates, the data are useful in a research mode to test some of the simplifying assumptions of PPS.

Next, we briefly overview our methods and definitions. This is followed by a discussion of data sources and variables. We then display 1984 cost shares for community hospitals by the nine census divisions, metropolitan statistical area (MSA) versus non-MSA, and by teaching status, followed by a critique and presentation of 10-year trends in price proxies by area. Regional cost shares and price proxies are then combined to evaluate the accuracy of using one national market basket. We conclude with a discussion of the policy implications of our findings.

Methods

Freeland, Schendler, and Anderson (1981) based their conclusion "that variation in weights among the Census Divisions ha[d] no substantial effect on the values of the Census Division indexes . . . " on a comparison of cumulative differences in price indexes among four models. These models are best summarized in the standard Laspeyres price index:

$$I_{rt} = \Sigma_j w_{rj} P_{rjt} / \Sigma_j w_{rj} P_{rjo}$$

where I_{rt} = Laspeyres index value for the r-th region in year t,

P_{rjt} = value of the price proxy of the j-th cost in the r-th region in year t,

P_{rjo} = the value of P_{rjt} in the beginning period $t = 0$, and

w_{rj} = the j-th cost share of hospitals in the r-th region.

In HCFA's national model, no regional distinction is made for either the cost shares or the price proxies, and the r subscripts drop out. At the other extreme is the regional model, which permits regional variation in both the shares and the proxies. The regional price model applies region-specific price proxies to national cost shares, and the regional weight model applies region-specific weights to national price proxies. Comparing the fully regional model to the national model shows how much error in total is produced by predicting regional inflation using one national market basket and a set of price proxies. One could argue that a certain amount of difference area could be attributable to market imperfections and regulatory constraints. It is hard to believe, however, that large differences in price trends, as opposed to levels, could be the result of these and not underlying real differences in local economies. HCFA found little difference between the regional weight and national

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models, implying no material differences because of cost shares but somewhat different results using regional price proxies.

Two assumptions are critical to the validity of this work. First, all of the cost shares and price proxies, ideally, should be available for all nine census divisions. This was not true. The wage and professional fee proxies were available for only the four census regions, and several other minor proxies were only available nationally. Second, the cost shares should be sufficiently disaggregated to reflect important differences in interregional input mixes. The HCFA disaggregation was limited in two respects. First, the 50-percent labor share was not decomposed at all by area or by hospital type. Second, the energy and "all other nonpayroll" shares, although varying by area, were used as control totals for proportionally allocating costs. For example, if energy costs were 5.0 percent in New England, then Bureau of Economic Analysis (BEA) input-output data on fuel oil, electricity, etc., from national statistics were adjusted proportionally to the 5-percent control percentage. This assumes equal energy mixes across regions.

Two improvements are made in this article, although adjustments still fall short of an ideal correction. Wages are broken down into five groups, using AHA data, and greater regional diversity in the price proxies is displayed. The HCFA four-model methodology is then used to reassess the key assumptions of national cost weights and price proxies now used in the PPS update factor.

Definition of cost shares

HCFA used 18 expense categories in its original PPS market basket. Freeland, Schendler, and Anderson (1981) had 23 in their original article, but 4 were directly related to capital, and medical professional fees were dropped as a Medicare Part B expense. Weights were constructed in a two-step process. First, aggregate cost shares for seven services were estimated from the 1977 AHA annual survey: wages and salaries; employee benefits; nonphysician professional fees; depreciation; interest; energy; and all other expenses. HCFA then used unpublished interindustry expenditure flow data on hospitals from BEA to spread out the remaining "all other" and "energy" subcomponents.

In this article, 13 cost shares are examined; the 7 HCFA shares, plus 6 others that are available on the AHA annual survey. Within total payroll are five subcategories: physician and dentist salaries, intern and resident salaries, other trainee salaries, all nursing salaries, and all other payroll. This breakdown, although better than the single wage category currently being used, is still very limited. Nursing and all other payroll make up 95 percent of all payroll expenses, with no further accounting for skill-mix differences within the two categories.[1] The best that can be said for using the five AHA labor categories is that they do distinguish between physicians and nurses, and between these two medical inputs and all nonmedical support staff.

Seven nonpayroll categories are available, including two that are capital related: employee benefits, professional fees, contract nursing, depreciation, interest, energy, and all other nonpayroll. This breakdown includes only five noncapital categories, of which employee benefits and other nonpayroll make up more than 70 percent of all nonpayroll expenses. Moreover, because Medicare pays physician professional fees through Part B, the professional fee cost weight was adjusted downward in PPS to a trivial share (0.56 percent), reflecting the legal, auditing, and other nonphysician outside professional costs.

Price proxies

Once the cost shares are chosen, a set of price proxies is needed to forecast the relevant price changes into the prospective payment period. First, we constructed a wage series for the nine Census Divisions based on AHA annual survey data on full-time equivalents (FTE's) and payrolls by individual hospital. For employee benefits, two series were collected for the nine Census Divisions: the BEA supplements to wages and salaries; and the AHA annual survey data on hospital employee benefits. For nonphysician professional fees, only the national BEA Average Hourly Earnings (AHE) series for private, nonagricultural workers was available (AHE-Private). No series were developed for the two capital costs for this report, as PPS covers only operating costs. The energy cost share was decomposed into three subindexes based on the Bureau of Labor Statistics (BLS) Consumer Price Index for All Urban Consumers (CPI-U) data: fuel oil; electricity and piped gas (together); and water and sewerage maintenance. Fuel and electricity and gas were available on a four-region basis, and the third subindex was only available nationally. Two subcategories of "all other nonpayroll" were disaggregated ("food at home" and "private transportation"), with corresponding four-region price proxies taken again from the BLS CPI-U subcomponents. The four-region CPI-U services subcomponent was then used to forecast the residual other nonpayroll cost share.

Definition of community hospitals

HCFA currently uses a single, national hospital market basket and set of cost shares for all U.S. hospitals certified by Medicare. This includes not only

[1] AHA annual survey tapes do provide considerably greater detail on full-time employees by occupational group, (e.g., registered nurses, licensed practical nurses, technicians, administrators), but unfortunately, corresponding payroll data are only reported on the five broader categories.

community hospitals but non-community hospitals as well, e.g., psychiatric, rehabilitation, and chronic disease facilities.[2] The Prospective Payment Assessment Commission (ProPAC)(1985) has already shown how different the labor shares are between community and non-community hospitals. The focus here is on regional and hospital-type differences among community hospitals, but does extend the analysis to non-community hospitals as well.

The operational definition of a community hospital for this analysis is a Medicare-certified, non-Federal, AHA-designated, short-term hospital (average length of stay of less than 30 days), including general medical and surgical; obstetrics and gynecology; ear, nose and throat; orthopedic; other specialty; and any children's hospitals of the type just named (AHA service codes 10, 44-45, 47, 49, 50, 55, 57, and 59), and excluding all hospitals in outlying territories. This list produces 5,676 short-term, non-Federal community hospitals certified by Medicare, using the 1984 AHA annual survey data tape.

The community hospital cost shares shown later will not exactly match those published by HCFA for several reasons. Relevant here is the difference in sample frames: ours is community based, but the HCFA cost shares cover all Medicare-certified hospitals. The principal difference is a smaller labor share, because psychiatric and other labor-intensive long-term hospitals are excluded.

We also produce cost shares for four kinds of non-community hospitals: psychiatric (AHA service codes 22 and 52), rehabilitation (46 and 56), chronic disease (48 and 58), and long-term general (AHA service code 10 with average length of stay [ALOS] greater than 30). We also required them to be Medicare-certified, which resulted in significant deletions for psychiatric and long-term general hospitals.

Data sources and variables

1984 American Hospital Association survey

The primary data source for estimating the cost shares in this article is the 1984 AHA annual survey data tape. Summary statistics from this tape are presented in *AHA Hospital Statistics, 1985* (American Hospital Association, 1986). The expense data are on a hospital-specific fiscal, not calendar, year basis, with a stated preference for October 1983 through September 1984. Differing fiscal end dates add noise to the data—presumably random by hospital characteristic.

ProPAC staff merged a few key PPS variables from the 1982 HCFA hospital-specific file, including census division, intern-to-bed ratios, and MSA/non-MSA status under PPS. All three were used as stratifiers in the descriptive analysis.

Missing and bad data

Although AHA asks hospitals to report expenses by each of the 13 HCFA cost categories, not all do so. Indeed, significant missing data exist for all items. Of 6,241 non-Federal, Medicare-certified hospitals, for example, only 3,319 reported the 5-part breakdown of payroll; only 4,055 reported the 7 individual nonpayroll categories.

Nonreporting presents some difficult methodological choices for the analysis. If we analyze only reported data, we must drop up to one-half of the hospitals, producing very small cell sizes for some hospital characteristics. An even more serious problem is that hospitals were more likely to report a subtotal such as all payroll, rather than individual subcomponents, generating missing data points that were clearly positive, but unknown. The alternative was to use the AHA estimated data, which was done despite the questionable imputation results at the hospital level. HCFA uses the AHA estimated data as well. Certainly, some replacement is better than none, because of the likely underestimate using unreplaced (presumably positive) data. It also results in a full, consistent set of hospitals for all 13 cost shares.

The FTE data on the 1982 annual survey tape were overstated for some unknown reason, an error that also appears in *Hospital Statistics* for that year. Thus, we were forced to impute FTE percent changes for 1981-82 and 1982-83 by region, using the single, national percent change.

Weighting

We chose to follow the method used by HCFA and produce weighted cost shares by summing numerator and denominator separately, then taking ratios for all U.S. community hospitals and by subcategory, e.g., non-MSA New England hospitals. The tradeoff is the lack of variance statistics upon which to base mean-difference tests. At this point, we felt it more important to replicate the HCFA methodology and compare the absolute differences, first in the cost weights, then in the price indexes using the price proxies, than to perform statistical tests on the shares alone. In any event, such tests are further confounded by the high frequency of imputed data, which is imputed randomly within the cell.

Price proxies

BLS and BEA are the principal sources for the price proxies. BLS collects the Average Hourly Earnings (AHE) series, both for all private industry and for hospitals separately. It is also responsible for the Consumer Price Index. The BEA collects data on personal income by source, which we use to construct a fringe-benefit series. In this section we describe the various data sources and their limitations.

[2] In the first article by Freeland, Anderson, and Schendler (1979), only community hospitals were analyzed. Their followup article on regional variation (Freeland, Schendler, and Anderson, 1981) never explicitly states what hospital group is being analyzed, but source notes to Figure 1 indicate that it is "Medicare-certified" community hospitals as well. When the same authors extend their analysis to constructing the PPS update factor, however, they broaden their scope to include all Medicare-certified hospitals.

A price proxy for fringe benefits was derived from several separate estimates published by BEA and BLS. Supplements to wages and salaries are made up primarily of employer contributions to social insurance and to private pension and welfare funds. Employer contributions for social insurance consist of Federal, State, and local social insurance funds. This measure was not available at the State or regional level, but was estimated by multiplying the available regional measures of personal contributions to social insurance (listed in the BEA Local Area Personal Income), times the national ratio of employer-to-personal contributions to social insurance. Employer contributions to private pension and welfare funds are listed by State in the BEA annual publication, *Local Area Personal Income*. Under "other labor income," it includes pension and profit sharing, group health insurance, group life insurance, workers' compensation, and supplemental unemployment.

Fringe benefits were put on a per-employee basis, using the BLS number of employees on nonagricultural payrolls published in *Employment and Earnings*. As with the figures for supplements, these data are available at the State level and were then grouped to the regional level.

The CPI-U and its components are published by BLS in the monthly *CPI Detailed Report* (among other sources). A breakdown is provided for all components at the national level and by the four census regions for most components at the regional level. Unfortunately, no breakdown is available for the nine census divisions.

Of the utility components in the PPS hospital market basket, only water and sewerage maintenance is not available at the regional level. The electricity and the utility (piped) gas components are listed together at the regional level. Also, fuel oil is listed with coal and bottled gas.

The base for this detailed utilities series is December 1977. The CPI-U (urban wage earners and clerical workers, base year of 1967) was available prior to this time, but breakdowns are only available for five very broad categories, with no regional utility price proxies. Our data are for October of each year.

Differences in expense shares

Five sets of expense shares are analyzed for community hospitals. All weighted shares are based on a full national sample of 5,676 community hospitals using AHA-replaced data.

Census division

The market basket cost weights by the nine census divisions and the entire United States for 1984 are displayed in Table 1. As seen in the total column, payroll costs in community hospitals averaged 48.49 percent, ranging from a low of 45.49 percent in East South Central (ESC) hospitals (e.g., Alabama, Mississippi) to a high of 51.49 percent in New England (NE). This range is somewhat lower than the data compiled by the HCFA Office of Research and Demonstrations for 1977 for all U.S. hospitals, which ranged from 48.5 percent for ESC to 54.3 percent for NE (data not shown). The discrepancy is primarily because of the exclusion of more labor-intensive long-term hospitals. Nonpayroll costs in the 1984 AHA survey averaged 51.89 percent.

Within payroll subcategories, other payroll was by far the largest, at 29.66 percent, followed by nursing at 16.40 percent. The ESC division was lowest in both nursing and all other payroll, and NE was high (but not highest) on both shares. One is struck by the lack of interregional variation in the two largest payroll shares—less than 2 percent for nursing and slightly more than 6 percent for all other payroll. Variations in the other three categories are much smaller in absolute terms. The result is very little discrimination within the labor category, 6 points at most.

Nonpayroll shares are seemingly more diversified, but not greatly so. The residual category, other nonpayroll, averages 28.27 percent in 1984, or 3 times that of the next largest category, employee benefits (8.94 percent). Professional fees are the third-largest noncapital share, at 4.21 percent, but again, most of these fees are not reimbursable under Part A of Medicare, making the size of the share unrepresentative of its importance to the update factor.

Depreciation is actually the third largest nonpayroll item, at 4.76 percent nationally. Interestingly, the two divisions at the extremes (in terms of payroll shares), ESC and NE, almost switch positions on capital costs. New England shows the lowest depreciation-plus-interest share, 6.53 percent, versus 8.01 percent in the ESC. Only West North Central (WNC)(8.29 percent) and Mountain hospitals (8.46 percent) had higher capital shares than in the ESC (derived from Table 1).

Depreciation and interest, as a percent of total cost, appear to differ more across Census Divisions than any of the other nonpayroll categories. Employee benefits, for example, range from 10.10 percent (Pacific) to 8.14 percent (WNC), or 1.96 points around a mean of 8.94 percent. Other nonpayroll costs range 5.09 points around a mean of 28.27 percent. Depreciation and interest shares, by contrast, range 1.93 points around a mean of 7.6 percent. When these capital costs are paid prospectively under PPS, the issue of regional market baskets will take on added importance.

The very narrow range for energy costs is surprising, given the radically different climates around the country. The WNC and NE divisions have almost identical shares (2.73 and 2.72 percent, respectively); but Mountain hospitals are lowest, at 2.19 percent. Apparently, the low heating costs in the southwestern part of the country are almost completely offset by higher air conditioning costs. Regionalized energy weights, therefore, should have very little impact on the inflation forecasts, contrary to expectations.

Table 1

Market basket cost weights for community hospitals, by census division: United States, 1984

Cost share	Total	New England	Middle Atlantic	South Atlantic	East North Central	East South Central	West North Central	West South Central	Mountain	Pacific
					Census division					
Number of hospitals	5,676	234	550	733	847	451	752	731	329	605
Payroll					Percent of total expenses for hospitals reporting line item[1]					
Total	48.49	51.49	51.15	47.14	49.93	45.49	49.46	46.57	46.24	46.84
Physicians and dentists	1.24	2.05	2.32	0.86	1.27	0.83	0.83	0.73	0.58	0.82
Interns	1.11	1.32	1.71	1.01	1.15	0.89	0.90	0.75	0.68	0.90
Trainees	0.08	0.06	0.16	0.05	0.04	0.05	0.06	0.05	0.04	0.04
Nursing	16.40	17.29	16.21	16.34	16.44	15.92	17.45	16.67	16.36	16.05
Other	29.66	30.77	30.75	28.88	31.03	27.80	30.22	28.37	28.58	29.03
Nonpayroll										
Total	51.89	48.64	49.33	53.17	50.26	54.97	51.27	53.59	54.23	53.62
Employee benefits	8.94	9.29	9.53	8.43	9.30	8.25	8.14	7.53	8.43	10.10
Professional fees	4.21	3.49	3.41	4.20	3.83	4.65	4.44	4.52	5.09	5.28
Contract nursing	0.27	0.12	0.32	0.20	0.12	0.21	0.13	0.26	0.40	0.52
Depreciation	4.76	4.16	4.31	4.74	4.96	5.10	5.24	5.13	5.08	4.51
Interest	2.88	2.37	2.99	2.72	2.77	2.91	3.05	2.97	3.38	2.64
Energy	2.56	2.72	2.66	2.58	2.63	2.65	2.73	2.57	2.19	2.21
Other	28.27	26.49	26.11	30.30	26.65	31.20	27.54	30.61	29.66	28.36

[1]Columns do not add to 100.00 because of different numbers of reporting hospitals by line item.

SOURCE: American Hospital Association, Chicago: Data from the 1984 Annual Survey.

Location and teaching status

The identical set of 13 cost shares for Metropolitan Statistical Area (MSA) versus non-MSA and teaching and non-teaching hospitals is shown in Table 2. The MSA designation is the one used by PPS. Teaching status has been defined in Table 2, according to HCFA regulations, as any hospital with a positive intern- or resident-per-bed ratio. This is a broader definition than that used by AHA, which is any hospital affiliated with a medical school. Many hospitals have residency programs without such an affiliation.

Most of the MSA and non-MSA cost share differences are far more trivial than those found across regions, suggesting that factors other than population density play a larger role. Physician and intern salary shares show the most variation, as expected. It is interesting that non-MSA hospitals have higher capital cost shares (7.93 percent versus 7.52 percent in MSA hospitals) despite their much smaller bed sizes. Recent expansion and renovation, coupled with declining utilization, no doubt explain their higher fixed costs.

Differences by teaching status are more marked. For example, the share of total payroll is 3 points higher in teaching hospitals (49.97 versus 47.15 percent in non-teaching hospitals). The former naturally rely more on physician labor and relatively less on nurses: In teaching hospitals, 3.64 percent of payroll is for physicians, compared with only 0.89 percent in non-teaching hospitals, and the nursing share of the latter is about 1.45 percent less. Teaching institutions also have a large other payroll share.

The larger nonpayroll share in non-teaching hospitals comes primarily from three sources. Professional fees are 4.86 percent of expenses in non-teaching hospitals versus only 3.62 percent in teaching institutions. This is likely the result of more physicians on salary in teaching hospitals and of more outside accounting and legal services in non-teaching hospitals, which cannot afford as many salaried professionals.

Somewhat surprising is the higher capital cost share in non-teaching hospitals: 8.17 percent in non-teaching hospitals versus 7.08 percent in teaching hospitals. We know that teaching hospitals are much larger and invest several times as much in fixed and movable capital annually (Cromwell et al., 1987). This is reflected in the much higher average annual depreciation and interest expenses per teaching hospital ($4.2 million) compared with non-teaching hospitals ($1 million), as reported on the 1984 AHA survey.

Two explanations of this paradox are possible. First, teaching hospitals receive significantly more donations than non-teaching hospitals and have better access to tax-exempt loan markets—particularly compared with proprietary hospitals. More important, however, are the enormous labor costs of teaching hospitals that dominate any (large) differences in capital costs. In 1984, the average teaching hospital spent roughly $35 million on payroll plus employee benefits, compared with only $6.7 million for non-teaching hospitals, more than a 5-to-1 difference.

Community versus non-community hospitals

HCFA currently uses a single set of cost shares for all U.S. Medicare-certified hospitals, whether they are covered by PPS or the earlier TEFRA legislation. The latter include non-community hospitals providing

Table 2

Market basket cost weights for community hospitals, by location and teaching status: United States, 1984

Cost share	Total	MSA	Non-MSA	Teaching	Non-teaching
Number of hospitals	5,676	2,676	2,556	1,012	4,220
Payroll		*Percent of total expenses for hospitals reporting line item*[1]			
Total	48.49	48.82	47.80	49.97	47.15
Physicians and dentists	1.24	1.37	0.54	1.75	0.68
Interns	1.11	1.27	0.20	1.89	0.21
Trainees	0.08	0.08	0.02	0.10	0.03
Nursing	16.40	16.25	17.64	15.78	17.23
Other	29.66	29.85	29.40	30.45	29.00
Nonpayroll					
Total	51.89	51.42	53.26	50.24	53.41
Employee benefits	8.94	9.08	8.36	9.30	8.60
Professional fees	4.21	3.98	5.44	3.62	4.86
Contract nursing	0.27	0.26	0.19	0.25	0.26
Depreciation	4.76	4.70	5.04	4.57	4.96
Interest	2.88	2.82	2.89	2.51	3.21
Energy	2.56	2.52	2.84	2.57	2.56
Other	28.27	28.06	28.50	27.42	28.96

[1]Columns do not add to 100.00 because of different numbers of reporting hospitals by line item.

NOTES: Definitions of "urban" and "teaching" are those used by the Health Care Financing Administration (HCFA) in the prospective payment system. A positive intern share (0.21) in non-teaching hospitals is likely the result of a more stringent definition of an intern by HCFA than by hospitals reporting costs to the American Hospital Association. MSA is metropolitan statistical area.

SOURCE: American Hospital Association, Chicago: Data from the 1984 Annual Survey.

Table 3

Comparison of cost weights, by type of hospital: United States, 1984

Cost share	TEFRA hospitals[1]					PPS community[2]
	Total	Psychiatric	Rehabilitation	Chronic disease	Long-term general	
Number of hospitals	483	377	64	35	7	5,676
Payroll	Percent of total expenses for hospitals reporting line item[3]					
Total	64.99	65.08	57.63	73.95	72.45	48.49
Physicians and dentists	5.01	5.22	3.48	4.50	3.74	1.24
Internists	0.41	0.43	0.37	0.29	0.53	1.11
Trainees	0.13	0.16	0.01	0.01	0.02	0.08
Nursing	13.15	12.70	13.73	17.73	18.17	16.40
Other	46.29	46.57	40.04	51.42	49.99	29.66
Nonpayroll						
Total	39.13	37.77	44.73	47.03	53.33	51.89
Employee benefits	13.22	13.30	10.65	14.97	19.30	8.94
Professional fees	2.75	2.75	2.98	1.75	5.70	4.21
Contract nursing	0.22	0.16	0.53	0.58	0.43	0.27
Depreciation	2.35	2.06	3.95	3.89	3.20	4.76
Interest	1.30	1.06	3.07	1.94	1.21	2.88
Energy	3.73	3.73	3.03	4.56	4.47	2.56
Other	15.56	14.71	20.52	19.34	19.02	26.27

[1]Hospitals excluded from the prospective payment system by the Tax Equity and Fiscal Responsibility Act (TEFRA).
[2]Hospitals included under the prospective payment system (PPS).
[3]Columns do not add to 100.00 because of different numbers of reporting hospitals by line item.

SOURCE: American Hospital Association, Chicago: Data from the 1984 Annual Survey tape.

long-term, specialized care (e.g., psychiatric, rehabilitation, chronic disease). The 1984 cost weights for four types of TEFRA hospitals, along with the set of national weights for PPS hospitals, are shown in Table 3. There were 377 psychiatric hospitals certified for Medicare, 64 rehabilitation institutions, 35 chronic disease hospitals, and another 7 long-term general hospitals. The number of included hospitals is significantly reduced for both psychiatric and long-term general hospitals because many are for-profit, operating without Medicare patients.

The cost weights are dramatically different between PPS and TEFRA hospitals, far more than within community hospitals by any stratifier. First, the total payroll share of TEFRA hospitals is 16.5 points higher (64.99 versus 48.49 percent). Adding in employee benefits of 13.22 percent on average brings the average TEFRA-hospital labor share to more than 78.21 percent versus only 57.43 percent for PPS community hospitals.

Several other differences are worth noting among the various cost shares. First, TEFRA hospitals have 4 times as many physicians on salary as PPS hospitals, suggesting a "richer" occupational staffing—at least among the medical personnel. Offsetting this richness is their much higher other payroll share that is indicative of a custodial facility. This is automatically reflected in a lower total nonpayroll share (39.13 versus 51.89 percent).

A second noteworthy difference is in the capital share. PPS hospitals average 7.64 percent for depreciation and interest, and TEFRA hospitals average only 3.65 percent, more than a 2-to-1 difference. This could be the result of the nonprofit public orientation of some of these institutions, or the age of their capital stocks, or the technologically less sophisticated nature of the care being delivered.

Regional differences in price proxies

During PPS transition, HCFA has used the national BLS Annual Hourly Earnings for Hospital Employees (AHE-806) series to forecast wage increases. Compound annual growth rates in AHA total payroll costs (excluding fringe benefits) and AHA-reported fringe benefits for the 1972-84 period, along with the BEA fringe benefit series, are reported in Table 4.

Both the AHA payroll per FTE and the BLS national AHE-806 series (not shown in Table 4) move closely together around an annual average increase of

Table 4

Compound annual growth rates in selected wage price proxies, by census division: United States, 1972-84

Census division	AHA payroll expenses per FTE 1972-84 (1)	AHA fringe expenses per FTE 1972-84 (2)	BEA fringe benefits per worker 1973-83 (3)
	Percent		
New England	7.9	13.1	10.9
Middle Atlantic	7.6	12.1	10.4
South Atlantic	9.0	14.3	10.5
East North Central	8.7	13.8	9.7
East South Central	9.1	14.9	10.9
West North Central	9.2	14.1	10.7
West South Central	9.9	15.2	11.2
Mountain	9.6	14.9	10.5
Pacific	8.7	13.8	10.5
U.S. average	8.6	14.0	10.6

NOTES: AHA is American Hospital Association. BEA is the Bureau of Economic Analysis. FTE is full-time employee.

SOURCES: Columns (1) and (2): American Hospital Association, Chicago: Data from the annual survey tapes, 1972-84. Column (3): Bureau of Economic Analysis: Data from the Local Area Personal Income files, 1973-83, and from the Survey of Current Business, 1973-83.

9 percent. The AHA series is generally higher than the BLS series by about four-tenths of one point on average, suggesting that either one could be used for measuring actual wage increases in the industry.[3] The BLS AHE-Private series (also not shown) is a full two points below either hospital-specific series, averaging only 7 percent annually. An improving skill mix in the hospital industry could explain part of the higher rate, although a catching-up process could also be occurring. Holding the industry to the AHE-Private trend would have reduced the update factor considerably.

Although the use by HCFA of a single national wage trend assumes no temporal variance in wage inflation by region, growth rates do seem to vary somewhat by census division (Table 4). Annual growth rates ranged from a low of 7.6 percent annually in Middle Atlantic hospitals to 9.9 percent in West South Central hospitals (e.g., Texas, Oklahoma).

HCFA has also used an external national price index (generated from BEA data) to forecast changes in fringe benefits for hospital employees. We used more disaggregated data by State to decompose the series by division. Column 3 of Table 4 summarizes our decomposition of the BEA wage supplement data by division. The compound growth rate over the period was 10.5 percent, with a peak of more than 15 percent in 1975. As a result, the nominal dollar value of all employer-paid fringe benefits nearly tripled in 11 years from $1,257 to $3,579.

Differences in the nominal level of fringe benefits are substantial ($3,899 in the Pacific versus $3,287 in the South Atlantic), but very little time-trend difference is observed. West South Central employees enjoyed the highest growth rate, 11.2 percent annually, but this is only 1.5 points above the lowest division's growth rate (ENC with 9.7 percent).

The trend in hospital benefits as reported to AHA (column 2 of Table 4) averaged 13.6 percent, compounded annually, between 1973 and 1984. This is more than 3 points per year higher than the BEA series on nonagricultural workers used by HCFA in the update. Variation in this rate was also fairly limited. What differences do exist are easily explained by the wage changes in column 1.

The percent changes in the CPI-U index for six subcategories used to forecast selected nonlabor cost shares are shown in Table 5. Unfortunately, only a four-region decomposition is available, and only beginning in 1979.

The overall CPI-U (all items) rose 10.24-12.64 percent annually from 1979 to 1981, falling back to less than 5 percent by 1984 (CPI-U overall). Most of the individual components follow the same temporal pattern, with fuel oil costs the most volatile year to year.

Some regional variability in the indexes is evident, albeit not dramatic. At an extreme are the regional differences in fuel oil trends. In 1979, fuel oil costs rose 56.88 percent, ranging from a low of 42.89 percent in the West to 61.83 percent in the Northeast. Conversely, fuel oil costs fell 7.75 percent nationally in 1983. The Northeast clearly shows more volatility in oil prices, but its mean 6-year growth rate (15 percent) is remarkably similar to the West's (14 percent).

Given the large business services cost share forecasted by the CPI-U services index, the lack of regional variation is noteworthy. In 1984, for instance, the mean U.S. price increase for services was 5.57 percent, with a range of only plus or minus 1 point by region.

Simulation of input price indexes

The cost shares in Table 1 can be merged with the price proxies in Tables 4 and 5 to simulate the effects of using national, rather than regional, values in updating PPS payment rates. Comparing the fully national and fully regional models by region shows how much error is produced at the regional level by using one national rate of input price inflation and set of cost shares. Further comparing the regional price and regional weight models allows us to say how much of the error is attributable to using national cost weights versus national price proxies.

The simulations reported later are based in large part on the data provided on regional and national cost weights shown in Table 1 and the numerous price trends reported in Tables 4 and 5. Several minor adjustments were made in the shares and prices to improve the scope and generalizability of the simulations. First, the cost shares appearing in Table 1 include several items not currently paid for by Medicare on a prospective basis. This required adjusting the cost shares upward for the exclusion of intern/resident salaries, for the medical component of professional fees, and for the elimination of depreciation and interest. According to Freeland, Schendler, and Anderson (1981), medical fees were 89 percent of all professional fees, resulting in a corresponding percent reduction in the cost share of medical fees.

Second, AHA reports only a single cost share for energy, although several price proxies exist for specific utilities. HCFA uses the AHA national energy share as a control total and applies it to the detailed utility expenditure data it receives from the BEA Interindustry Economics Division. We have done the same, except that our control totals vary by region in the regional model. The four energy shares are derived from the AHA control totals, using the most recent HCFA June 3, 1986 cost weights, published in the *Federal Register*. The energy shares are fuel oil (49.7 percent), electricity (34.5 percent), piped gas (14.8 percent), and water/sewerage 1.0 percent).

Third, HCFA further disaggregates food and private transportation from the other nonpayroll

[3]The similarity of the two series vindicates somewhat the AHA data, which have been maligned—particularly for payroll and FTE counts. One reviewer of this article pointed out, however, that in 1987, the BLS Employment Cost Index rose at only one-half the rate of AHA's panel survey estimate of payroll expenses per FTE.

category, using the same algorithm. We did the same, again using regional control totals for the regional models. HCFA shows food as 11.7 percent of the other nonpayroll control total and private transportation as 3.5 percent. The residual category's share is correspondingly reduced.

Fourth, HCFA does not show a separate contract nursing cost weight. As it is a trivial share, we left it as is, using the AHE-Private price proxy to forecast its price trend.

Fifth, the regional time series for the CPI-U utilities component is particularly short, 1979-84. To push the simulations further back in time, we extended the series back to 1976, using just the national CPI-U utilities growth rates, making the assumption that regional differences were nonexistent prior to 1979. Thus, the models using regional prices over the 1976-84 period slightly understate the full effects of regional price trend differences. At best, only four census regions are distinguished for utilities between 1979 and 1984.

Numerous simulations could be done with the different cost shares, but we constrained our work in the first instance to differences stemming from regional differences, using the shares in Table 1. A national update factor was constructed as a weighted average of the regional price trends, the weights being the proportion of community hospitals in each of nine regions.

Competing price proxies also expand the number of simulations. Two wage-and-salary proxies exist, the AHE-806 national series used by HCFA, and the AHA payroll-per-FTE series, aggregated by hospital up to the region. Two fringe benefits series also exist, the BEA nonagricultural worker fringe benefits and the AHA employee benefit series. Given our interest

Table 5

Percent changes in selected components of the Consumer Price Index–Urban, by region: United States, 1979-84

Component	All regions	Region			
		Northeast	North Central	South	West
		Percent change			
Business services					
1979	11.95	9.86	14.21	13.28	13.30
1980	14.10	18.83	14.62	13.44	15.81
1981	14.60	14.18	12.33	15.08	17.38
1982	6.81	6.64	10.60	7.05	2.52
1983	2.91	4.42	2.33	2.80	1.93
1984	5.57	6.50	5.10	4.59	6.14
Fuel oil					
1979	56.88	61.83	58.97	44.06	42.89
1980	18.67	15.51	16.81	21.38	22.60
1981	20.40	21.90	19.43	18.35	15.21
1982	0.67	-0.42	0.53	4.57	2.85
1983	-7.75	-10.09	-6.59	-3.44	-0.44
1984	0.34	0.65	-0.24	0.58	-0.39
Electricity and piped gas					
1979	1.54	10.08	0.99	4.36	6.57
1980	16.37	11.70	13.92	11.65	38.94
1981	13.72	13.14	14.33	17.91	7.17
1982	14.64	13.22	14.18	14.13	18.60
1983	5.37	3.50	8.22	4.40	4.64
1984	4.68	4.01	5.16	3.27	7.08
Food at home					
1979	10.58	8.41	9.06	9.54	8.86
1980	9.15	10.84	10.12	11.59	10.52
1981	4.65	4.74	4.03	4.20	6.17
1982	2.68	2.95	2.37	2.54	2.94
1983	1.04	1.19	-0.35	1.79	1.50
1984	3.93	3.66	4.01	3.99	4.09
Private transportation					
1979	17.79	17.52	18.12	17.03	18.55
1980	14.07	14.10	13.51	15.35	13.13
1981	11.55	11.58	11.48	11.64	11.54
1982	2.54	1.84	2.01	2.68	3.86
1983	3.19	3.85	3.14	3.71	1.92
1984	3.26	2.51	2.87	3.28	4.53
Overall					
1979	12.20	11.14	13.10	12.18	12.56
1980	12.64	12.38	12.81	12.34	13.13
1981	10.24	10.34	8.32	10.47	12.04
1982	5.07	4.62	7.08	5.37	2.85
1983	2.89	3.44	2.62	3.21	2.27
1984	4.20	4.52	3.65	3.90	4.74

SOURCE: Bureau of Labor Statistics: Data from the Consumer Price Index Detailed Report, 1979-84.

in regional variation in hospital cost inflation, we show results using only the AHA data, because of their more disaggregated wage information.

The results for the four cost share/price proxy simulation models are shown in Table 6. The results for the fully national model are shown on the top line of the table, the so-called "baseline" trend. Three sets of regional simulation results are presented separately for the nine census divisions. Using AHA data that run from 1976 through 1984, the baseline national market basket update rose 129.2 percent, or 10.4 percent compounded annually. The fully regional model deviated from this baseline considerably over the period. The Mid-Atlantic region's results indicate

Table 6

Simulated percent changes in the update factor for regional market baskets, by census division: United States, 1976-84

Census division	1976-84		
	Percent growth	Deviation from baseline	Compound growth rate
	Percent change		
U.S. total (baseline)	129.2	—	10.4
New England			
Regional weights	129.4	.2	10.4
Regional prices	121.4	-7.8	9.9
Regional model	121.1	-8.1	9.9
Middle Atlantic			
Regional weights	130.5	1.3	10.4
Regional prices	112.1	-17.1	9.4
Regional model	112.5	-16.7	9.4
East North Central			
Regional weights	129.6	.4	10.4
Regional prices	133.7	4.5	10.6
Regional model	134.1	4.9	10.6
West North Central			
Regional weights	129.2	0.0	10.4
Regional prices	141.1	11.9	11.0
Regional model	141.2	12.0	11.0
South Atlantic			
Regional weights	128.1	-1.1	10.3
Regional prices	134.9	5.7	10.7
Regional model	133.6	4.4	10.6
East South Central			
Regional weights	128.1	-1.1	10.3
Regional prices	141.3	12.1	11.0
Regional model	139.5	10.3	10.9
West South Central			
Regional weights	126.6	-2.6	10.2
Regional prices	153.1	23.9	11.6
Regional model	148.9	19.7	11.4
Mountain			
Regional weights	128.3	-.9	10.3
Regional prices	147.6	18.4	11.3
Regional model	146.1	16.9	11.3
Pacific			
Regional weights	130.4	1.2	10.4
Regional prices	133.8	4.6	10.6
Regional model	134.9	5.7	10.7

NOTES: These figures are derived from cost shares taken from Table 1. Selected price proxies include the American Hospital Association payroll and fringe price series from Table 4 and the nonlabor proxies from Table 5.

Table 7

Simulated percent changes in the update factor for hospitals

Hospital type	AHA payroll and AHA fringe benefits 1976-84	Compound growth rates
	Percent change	
Community hospitals under the prospective payment system	129.2	10.4
Hospitals under the Tax Equity and Fiscal Responsibility Act	143.3	11.1

NOTE: AHA is American Hospital Association.

a growth rate 16.7 percent below the national average (or 9.4 percent annually); New England, 8.1 percent below (9.9 percent annually). At the other extreme, the West South Central region had regional growth nearly 20 points higher than national growth, or 11.4 percent versus 10.4 percent annual growth. Comparing extremes, West South Central hospitals experienced input price inflation roughly 20 percent higher than that experienced by Mid-Atlantic hospitals.

It is also clear that the vast majority of the national/regional difference is the result of regional price trends and not of differences in cost shares. Results of the regional weight model differ little at all from the baseline 129.2 percent, but those associated with the regional price model are nearly identical to the regional model. This result is not unexpected and is quite consistent with the earlier work of Freeland, Schendler, and Anderson (1981). Hospital cost shares are quite similar across large regions of the country, with each region having a similar mix of small and large, labor-intensive and non-labor-intensive, community hospitals. The price proxies, by contrast, appear systematically different by region, at least over the 1976-84 time period.

Although there is very little effect of regionalized cost shares on regional update factors, the same cannot be said for differences between PPS-excluded TEFRA and PPS-included community hospitals. We have already shown the major differences in cost shares between the two groups. If one weights these cost share differences, using a set of national price proxies, the update differences are more dramatic than when done by region. These differences are summarized in Table 7. The TEFRA rate of input inflation is 14.1 points higher over an 8-year period, attributable solely to a much higher labor expense share. This amounts to seven-tenths of one percent difference, compounded annually.

Whether this difference persisted after PPS was implemented is less clear. According to the Office of the Actuary at HCFA, the two trends converged after 1983. This is likely explained by the generally low rate of inflation in wages and nonlabor inputs (Health Care Financing Administration, 1988).

Discussion

By using a single national update factor for all U.S. hospitals (whether they are under PPS or covered by TEFRA), HCFA has made the implicit assumption that input cost shares do not vary to any significant extent across relevant hospital characteristics. Our findings, using more recent data, confirm this assumption by region, urban or rural location, and teaching status (as did Freeland, Schendler, and Anderson, 1981). The assumption that cost shares are similar between PPS and TEFRA hospitals, on the other hand, is strongly rejected. The latter are far more labor oriented and hence potentially more sensitive to wage inflation (or deflation). One could argue that Medicare patients in TEFRA hospitals use a different input mix than do most patients, but the same argument could be applied to Medicare patients in PPS hospitals, yet HCFA uses average cost shares as weights. Substantially different results for TEFRA hospitals argue for a distinct set of cost weights until evidence is presented showing that the true cost shares are similar to those for Medicare patients.

Even though no differences in cost shares were uncovered by region, there is strong evidence that input price inflation does vary regionally, implying a systematic bias in using a single set of national price proxies. Simulations indicate that hospitals in the northeast have enjoyed an unanticipated gain from a single national market basket update, given their lower rate of input price inflation. Some of these differences may be attributable to rigorous hospital rate setting in New York, New Jersey, and other northeastern states. This would still not obviate the fact that hospitals in this region have experienced lower cost inflation than elsewhere.

Another problem with using regional price proxies is the tradeoff between the desire to have more meaningful cost categories—particularly for labor—and the availability of separate price proxies at the regional level. HCFA has recently decomposed the single "wage" category into nine census occupations and is using BLS Employment Cost Indexes (ECI's) to forecast trends nationwide. A nine-occupation ECI, unfortunately, is not available on a regional basis. Adjusting for skill mix should make the update more accurate where differences in occupation wage inflation exist, but some unknown amount of interregional inequity remains in the price proxies for updating costs.

A final issue arises in updating wages annually using regional wage proxies if the PPS wage index is periodically updated as well. Periodically updating the wage index effectively realigns MSA's and rural areas that are overpaid or underpaid using a national wage proxy. It does not, however, make up for lost revenues in the interim, nor does it adjust for nonlabor differences. On the other hand, given the difficulties in acquiring accurate regional price proxies for the new HCFA occupational categories, coupled with the periodic updating of the wage index, it would seem that the current strategy of a single national index is an acceptable compromise.

Of course, this does not apply to the PPS-excluded hospitals whose cost shares are exceptional, regardless of their location. Even if the market basket trends between PPS and excluded TEFRA hospitals have been similar in the recent past, this is not a sufficient argument for using a single market basket. We have shown that substantial differences arise at higher inflation rates. If two different sets of cost weights were used, the system would be no more complicated, and any meaningful differences in wage and nonwage inflation would be automatically corrected for, using more appropriate cost weights.

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