
Rural Hospital Wages and the Area Wage Index

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We examined data on hospital hourly wages and the prospective payment system (PPS) wage index from 1990 to 1997, to determine if incremental changes to the index have improved its precision and equity as a regional cost adjuster. The differential between average rural and urban PPS hourly wages has declined by almost one-fourth over the 8-year study period. Nearly one-half of the decrease is attributable to regulatory and reporting changes in the annual hospital wage survey. Patterns of within-market wage variation across rural-urban continuum codes identify three separate sub-markets within the State-level aggregates defining rural labor markets. Geographic reclassification decisions appear to eliminate one of the three. Remaining systematic within-market rural wage differences work to the reimbursement advantage of hospitals in the smaller and more isolated communities.

INTRODUCTION

The hospital area wage index is used by CMS to adjust prospectively set Medicare payment rates for regional variation in labor costs. Unlike most input price indexes that capture change over time, the wage index is a cross-sectional adjuster. It is recomputed each year to center on a value of 1.00 that represents the national aggregate hospital hourly wage. Index values have ranged from as low as 0.65 to as high as 1.50. Incorporating these values into Medicare's

hospital reimbursement formulas can result in operating payment differentials of more than 50 percent based simply on the hospital's geographic location, for discharges with the same diagnoses that occur in otherwise similar hospitals.

Because the index has such a powerful effect on the distribution of Medicare payments, it came under close scrutiny after it was first introduced in 1983 as part of the inpatient PPS. In the mid-eighties and early nineties several evaluations of the index were conducted for and by CMS and the Prospective Payment Assessment Commission (ProPAC) (Cromwell, Hendricks, and Pope, 1986; Prospective Payment Assessment Commission 1987, 1991, 1993; Williams, Pettengill, and Lisk, 1990; Wright and Marlor, 1990; Williams, 1991). ProPAC's 1993 Report to Congress recommended radical changes in the index labor markets by eliminating any use of geopolitical boundaries in their definition, and relying instead on a regional grouping scheme based on neighboring hospitals. This change was never implemented, due in part to a lack of consensus within the hospital industry. Between 1993 and 1995 CMS evaluated several alternative approaches to defining labor markets, including the one recommended by ProPAC, and concluded that none of these offered sufficient improvement in the measure to justify their increased complexity (*Federal Register*, 1993, 1994, 1995). Several incremental improvements to the index have, however, been implemented through regulatory and legislative intervention.

Criticism of the index has focused on the accuracy and timeliness of its source data, on its use of geopolitical boundaries to

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define economic markets, and on its failure to separate the effects of variation in the price of labor from those of occupational mix differences. Refinements in the wage survey instruments have addressed several of the problems regarding accuracy and precision of wage and hour data. For example, beginning in 1990 the wage surveys were incorporated into the hospital cost reports, which made them subject to annual audits and updates. Over the years greater accuracy in the hourly wage measurement has been gained by adding non-payroll benefits, home office costs, and contract labor to the data collected, and by excluding wages and hours for services not reimbursed through the PPS per-case rates. To address at least some of the problems inherent in using geopolitical boundaries to define labor markets, an administrative exception process was put in place in 1992 that allows for hospital reclassification from one labor market to an adjoining one, in accordance with certain statutorily defined criteria. There has been less consensus regarding whether or how to control for occupation mix differences in the computation of the index, but the Benefits Improvement and Protection Act of 2000 called for new occupation-specific wage data to be collected that will allow the index to begin to control for some differences by fiscal year (FY) 2003.

Since the introduction of prospective payment for hospital services, there has been a perception among rural providers, industry groups, and some policy analysts that the wage index unfairly reduces Medicare payments to rural hospitals, and is a factor contributing to their low operating margins (Wellever, 2000; National Advisory Committee on Rural Health, 2001; National Rural Health Association, 2001). Recent application of the hospital wage index to Medicare's new PPS for skilled nursing, hospital outpatient, home

health, and inpatient rehabilitation services has generated renewed interest in assessing its underlying validity as an input price adjuster (Medicare Payment Advisory Commission, 2001a). Concerns about the equity of inpatient PPS rates often arise from comparisons of Medicare margins across groups of hospitals. It has been well documented that in aggregate the Medicare margins of rural hospitals are consistently lower than those of urban hospitals (Prospective Payment Assessment Commission, 1996; Medicare Payment Advisory Commission, 2001b). Hourly wages tend to be lower in rural than in urban areas, and consequently the wage index values for the rural labor markets also tend to be lower than those for urban labor markets. But margins are indicators derived from proportional differences between payments and cost; the wage index should not be a factor contributing to low margins unless it is an inaccurate measure of relative labor costs.

Evaluating the factors that contribute to variation in PPS margins is complicated by the fact that although the basic components of the PPS payment formula (such as input price adjusters or resource weights to account for case mix) are intended to adjust for expected cost differences across efficient providers, other components to the formula are deliberate policy adjustments, designed to direct additional resources to targeted facilities in order to fulfill specific policy goals (Ross, 1999). Some special exceptions and payment additions are targeted to at-risk rural facilities, such as those available for sole community facilities and Medicare-dependent hospitals. The two largest policy adjustments are the indirect medical education (IME) adjustment available to teaching hospitals and the disproportionate share hospital (DSH) adjustment paid to hospitals providing a large share of indigent care. (IME

payments are also intended to compensate for higher patient care costs in teaching environments, but the IME formula used in the PPS payments has deliberately been made greater than the measured cost differences; it is the portion of the IME that is over and above the expected cost differential that represents a policy adjustment. DSH is usually considered a policy adjustment because the extra payment is meant to offset costs of care to non-Medicare patients.) Both of these special payment add-ons are directed primarily to urban facilities, and together they account for much of the difference between average rural and urban Medicare margins (Dalton, 2001).

In order to evaluate the accuracy or the fairness of specific cost-driven components to PPS formulas, it is necessary to examine how these adjustments are computed and to assess their influence on the margins, independent of the other components to the payment formulas that reflect other Federal policy objectives. This study of rural hospital wages and the area wage index focuses on one of the cost-driven components of the PPS payment formula. Our specific objective is to identify whether the incremental changes to the wage index—both in the quality of the wage data and in the definition of the labor markets—have improved its precision and validity as a regional payment adjuster for rural facilities. Eight years of reported hourly wage data and resulting wage index values are analyzed to identify trends in rural, relative to urban, hospital wages and to assess the sensitivity of the index to these changes. Potential problems in the State-level rural labor markets are evaluated, both before and after accounting for geographic reclassifications. Since all provisions of the area wage index are implemented in a budget-neutral manner, the issues discussed in this article do not affect the Medicare bud-

get in total. They do, however, affect the distribution of payments across hospitals, and can therefore raise concerns of equity in Federal policy.

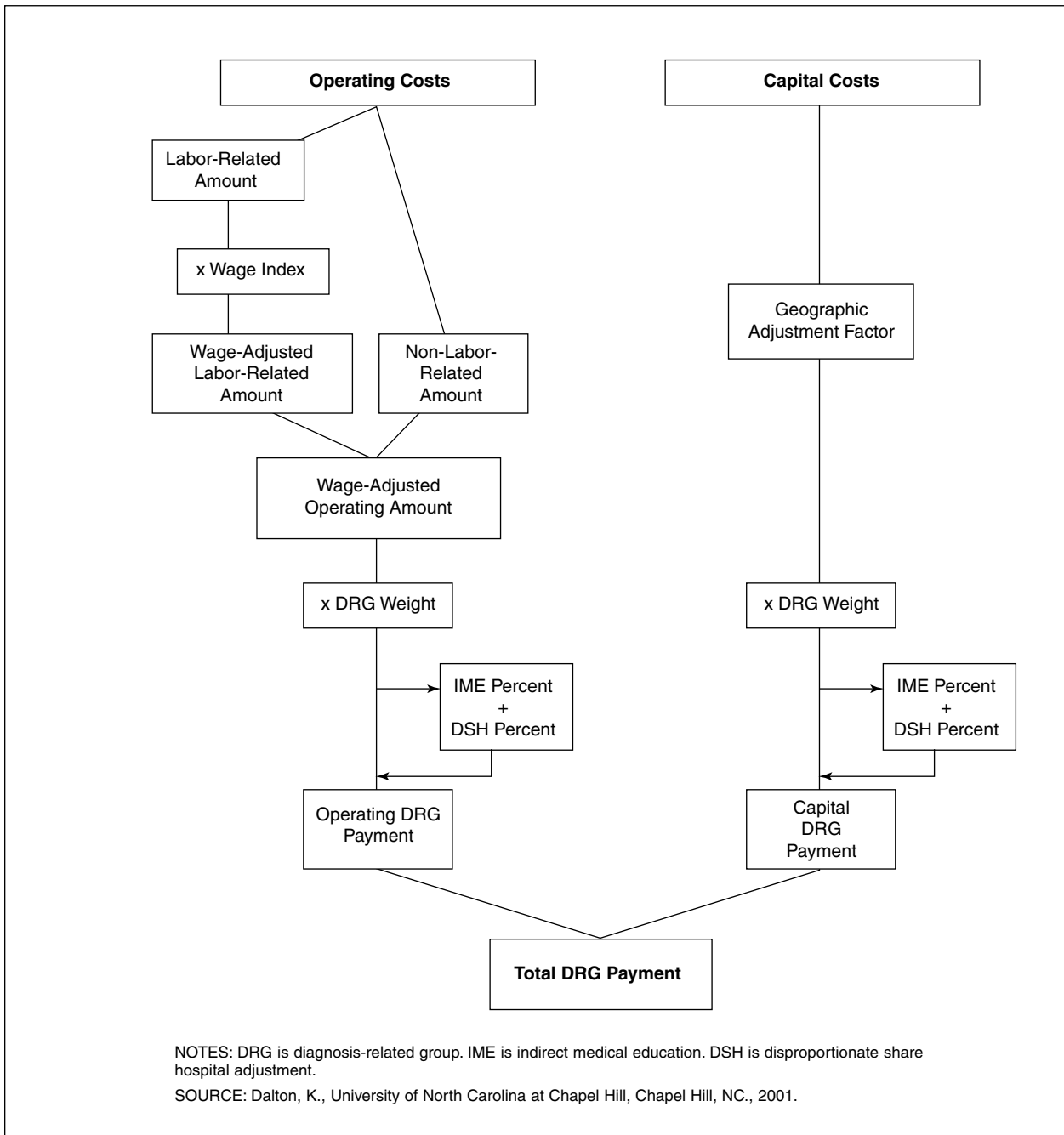
BACKGROUND

Hospital Payments

PPS hospitals are paid for inpatient care based on the sum of two fixed amounts per Medicare discharge (often referred to as standard payment amounts), one for operating costs and one for capital costs. These amounts are historically derived from average costs per Medicare discharge, which have been standardized to remove the effects of differences in average case mix and regional variations in labor costs (among other factors). An inflation-updated standard payment for each Medicare PPS discharge is then subjected to a variety of adjustments at the time that an individual claim for payment is processed, based on characteristics of the patient and the hospital. Figure 1 presents a simplified diagram of these rate adjustments.

The standardized amount for operating costs is itself made up of two components, one that is expected to be related to the price of labor and one that is not. The labor-related portion of the national rate is adjusted to reflect geographic variation in the average cost of labor, using the value of the wage index that is computed for each hospital's assigned labor market. The portion of the standard payment amount that is identified as labor-related is set by the Secretary of Health and Human Services and is derived from the sum of weights for selected cost components in the PPS market basket, which is a longitudinal input price index developed and maintained by CMS. The labor-related portion is currently set at 71 percent but it has been as high as 75 percent in earlier years. The standardized

Figure 1
Prospective Payment System Inpatient Hospital Payment Rate Computations



amount for capital costs also has a geographic adjustment factor (GAF), which applies to the full capital payment rate. Although the GAF is indirectly derived from wage index data, it has a relatively small effect on total payments and is not the focus of this article.

Labor Market Definitions

The methods used to construct the wage index are published annually in the *Federal Register* as part of both the Proposed and the Final Rules governing changes to Medicare’s inpatient PPS rates. Hospitals

are first grouped into labor markets that are defined either by metropolitan statistical area (MSA) or by State-level aggregates of rural areas that include data for all hospitals not located within an MSA. From the outset there has been concern that the rural market definitions are too broad, and that rural markets—in which 44 percent of all PPS hospitals are located—do not accurately reflect the employment conditions in which rural facilities operate. An administrative exception process has been in place since 1992 that allows hospitals to be redesignated to neighboring labor markets if certain conditions can be met. These exceptions are granted by the Medicare Geographic Classification Review Board (MGCRB), if a hospital is able to demonstrate that it competes in a labor market other than the one in which it is physically located. Reclassification is available to both rural and urban hospitals, provided they meet the statutory criteria. The criteria for reclassification to a neighboring MSA are complex and incorporate many exceptions, but are primarily governed by a combination of proximity and relative wage requirements. Between FYs 1993-2001 a rural hospital generally could qualify if it was located within 35 miles of the market to which it was requesting reclassification, if its hourly wages were at least 108 percent of the mean of its original assigned market and no less than 84 percent of the mean for the market to which it was requesting reclassification (*Federal Register*, 1992). The distance criteria are waived for sole community providers, however, and the relative wage criteria are less stringent for rural referral centers. The upper and lower relative wage thresholds were changed to 106 and 82 percent, effective October 2000. Congress also deems certain counties (those with a high proportion of residents commuting to work in neighboring MSAs) to be treated as urban

for purposes of the labor market definition. In the last year of data included in this study, approximately 14 percent of non-MSA hospitals were identified as having received a reclassification for wage index purposes, but the proportion has been growing; by FY 2000 the figure was 19 percent, and PPS Impact Files indicates that more than 24 percent of non-MSA hospitals were reclassified in FY 2001.

Index Construction

To construct the index, CMS first standardizes the reported hourly wages to remove the effects of different fiscal period-end dates, and then adjusts them to remove wage and hourly data from non-hospital portions of each facility's business. A market-level average hourly wage (AHW) is computed from the adjusted data, equal to the sum of the wage-related costs from all hospitals in that market divided by the sum of paid hours from all hospitals in the market. A similar computation is made from national data, summing across all hospitals that are paid using the Medicare PPS rates. The wage index is derived by dividing the AHW for each labor market by the national AHW.

The index is initially calculated based on the geographic assignment of each PPS hospital to a labor market, then recalculated using hospitals grouped according to the reclassifications that have been allowed by the MGCRB. Certain hold-harmless provisions are incorporated into the PPS regulations that protect non-reclassified rural hospitals from having their index values reduced as a result of any reclassification of higher-wage hospitals to neighboring markets. Similar provisions also limit the extent to which the reclassification of hospitals from neighboring areas can reduce the urban index values for hospitals originally located in the

markets to which the hospitals are being redesignated. As a result of the hold-harmless protections for urban hospitals, several MSAs end up having two possible index values applicable to facilities grouped in their labor market—one for the hospitals that are physically located within the MSA, and another that is applicable to hospitals reclassified into that MSA.

Two implications from the calculation of the wage index are worth noting. First, both within the market area and at the national level, AHWs are implicitly weighted by the number of paid hours at each hospital. Within any individual market, this allows the larger facilities (with generally higher average wages) to have greater influence on the AHW than smaller facilities. The market-level AHWs are higher than they would be if the hourly wages were simply averaged across all hospitals in the market. Because a large proportion of U.S. hospitals are small, the majority of institutions have hourly wages that are below the AHW for their own markets. A majority of the market-level AHWs are also below the national AHW, such that the mean and median hospital-level wage index values are both below 1.00.

Second, since the wage index is based on estimates of average hourly earnings, it reflects differences in both the price of labor and the mix of occupations within and across market areas. It is technically a labor cost index rather than a price index. Two hospitals located within the same labor market and sharing similar pay scales by job classification can have very different average wage costs, if they employ a different mix of nurses, technicians, and administrative personnel. Within markets, smaller facilities may have lower average wages than larger facilities because they offer fewer of the intensive or high technology services that demand more skilled employees. Looking across

markets, the effects of occupational mix and lower prevailing wages compound each other because the same kinds of communities that tend to have smaller facilities also tend to be found in areas with lower prevailing wages. If hospital hourly wages were adjusted to reduce or exclude the effects of occupation mix, the range from the lowest to the highest hospital-level PPS hourly wage would be smaller, and the range from the lowest to highest wage index value would also be smaller.

Using limited occupation-specific wage data from the 1980s, Pope (1989) concluded that rural PPS payments might be increased by an average of about 2 percent if hourly wage data were first standardized to eliminate differences in occupation mix. Estimates of the effect of controlling for occupation mix on the distribution of final PPS payments are very difficult to make, due to interaction between the wage index and diagnosis-related group (DRG) resource weights. The per-case payment is a multiplicative function of the wage index and the DRG weight, and across hospitals the wage index and the average DRG weights (also referred to as the case-mix index, or CMI) are strongly, positively correlated. Furthermore, the DRG weights themselves are derived from charge data that have already been standardized by the wage index. Thus, substantive changes to the wage index have the potential also to alter the DRG weights, to the extent that the distribution of cases by DRG is systematically different between high- and low-wage hospital settings.

DATA AND METHODS

For this study we extracted hospital payment and cost data from Medicare's Hospital Cost Report Information System for each year from 1990 to 1997, merging them with CMS's published wage index

Table 1

Hospital Location, Classification Status, and Average Wage Data: Federal Fiscal Years: 1990-1997

Variable	1990	1991	1992	1993	1994	1995	1996	1997
Number of Hospitals	5,065	5,099	4,959	5,045	4,986	4,874	4,849	4,789
Before Reclassifications					Percent			
Urban	53.4	53.4	53.8	53.7	55.6	55.4	55.2	55.4
Rural	46.6	46.6	46.2	46.3	44.4	44.6	44.8	44.6
After Reclassifications								
Urban	53.4	53.4	65.3	66.6	60.7	60.3	60.8	60.8
Rural	46.6	46.6	34.7	33.4	39.3	39.7	39.2	39.2
National Average Hourly Wage	\$17.26	\$18.26	\$18.93	\$19.55	\$20.09	\$20.78	\$21.18	\$21.70
Average Wage Index ¹								
Across all Markets	0.93	0.92	0.930	0.94	0.92	0.92	0.92	0.93
MSA Only	1.02	1.02	1.023	1.03	1.02	1.02	1.02	1.02
Non-MSA Only	0.81	0.80	0.830	0.83	0.80	0.80	0.80	0.81

¹ Unweighted means, computed across all hospitals within each group.

NOTE: MSA is metropolitan statistical area.

SOURCES: Author's tabulations from the Centers for Medicare & Medicaid Services Provider Specific Files for fiscal years 1990-1997 and standardized hourly wage data as used in constructing area wage indexes for fiscal years 1994-2001.

data. Using the modified Federal Information Processing Standards Codes from the Hospital Provider of Services File, we also merged county-level demographic variables from the Area Resource File. All PPS hospitals were included in the original study sample except those in Puerto Rico and other territories. Over the 8-year study period we were able to match observations across the three CMS files for 5,260 unique hospitals, for a final study sample of 39,660 observations. For several analyses we aggregated data using the U.S. Department of Agriculture's county-based Rural-Urban Continuum Codes, or RUCC (Butler and Beale, 1994). (For a description of the categories that we used, refer to the Technical Note at the end of this article.)

We analyze trends in the rural-urban wage differentials over time, and examine wage patterns across different levels of the rural-urban continuum, to investigate the potential for bias in the PPS rates due to distortion from the defined labor markets (Table 1). Systematic differences in the hourly wage patterns by geographically defined subgroups of hospitals, relative to their market-level AHW, are taken as evidence of poorly defined labor markets. If the labor markets are poorly defined, they

cannot accurately reflect exogenous market differences faced by hospitals in their hiring processes. To the extent that the wage index is based on inappropriate labor market boundaries, PPS rate differences exist that do not reflect true input price differences, which generate systematic over or underpayment by hospital location.

To assess within-market wage variation, we computed a measure of deviation capturing the proportional difference between an individual hospital's hourly wage and the mean hourly wage of its labor market. Within-market deviation is expressed as a percentage and computed for each hospital for each year as:

$$\left(\frac{AHW_{hospital} - AHW_{market}}{AHW_{market}} \right) \times 100$$

where $AHW_{hospital}$ stands for the average hourly PPS wage for each observation and AHW_{market} is the weighted average hourly wage computed within each defined labor market, within each year. The deviation measure is negative if the hospital's hourly wage is below the average for its market. If this were a pure price index, a hospital with a negative deviation value would have a clear reimbursement advantage over a

hospital with a positive one, and the deviation measure could be assumed to be unambiguously, inversely, associated with higher PPS margins. Because PPS hourly wages also reflect differences in occupation mix, the relationship is less straightforward. Negative deviation values may in part reflect hospital characteristics (such as size and technological sophistication), which are associated with a less expensive skill mix, but also with lower case mix, and therefore lower payments per case.

The market-level average wage can be affected by MGCRB decisions. In order to assess the impact of reclassifications on the index we have computed multiple sets of deviation measures, according to how reclassifications are accounted for in the market-level averages. CMS publishes each hospital's average hourly wage in the *Federal Register* each year, but the numerator and denominator data for the hourly figures are included only in the final wage surveys, which were not available for the earlier years of our study period. To obtain weighted averages across alternatively defined markets, therefore, we averaged the individual hourly wage data across hospitals after applying a weight equal to the number of full time equivalents (FTEs) reported by that facility for its acute hospital unit. Although this is not an ideal reconstruction, we were able to test for measurement error in a year for which both types of data were available. Final PPS wages and paid hours were extracted from the FY 1997 Wage Survey File that was made available to the public on the CMS Web site in May 2000. Market-level AHWs were recomputed using CMS's direct method, then compared with those computed using our FTE-weighted average method. The correlation coefficient across all sample hospitals in 1997 was 0.98. There was some variation by RUCC. Across all rural subgroups, the coefficients

ranged from 0.96 to 0.98, leading us to conclude that the FTE-weighted method is an acceptable substitute for direct computation of alternative market AHWs.

Hold-harmless provisions within the regulations that govern wage index calculations result in final wage index values that are a hybrid of those computed based on geographic location and those computed post-reclassification. To compute within-market deviation measures based on the final assigned index value for each hospital, we had to derive a third, synthetic, market-level AHW by multiplying the final assigned index value for that hospital by the published national AHW. Within individual markets, the deviation measure was then derived from whichever market-level AHW was applicable to that hospital, for that MSA.

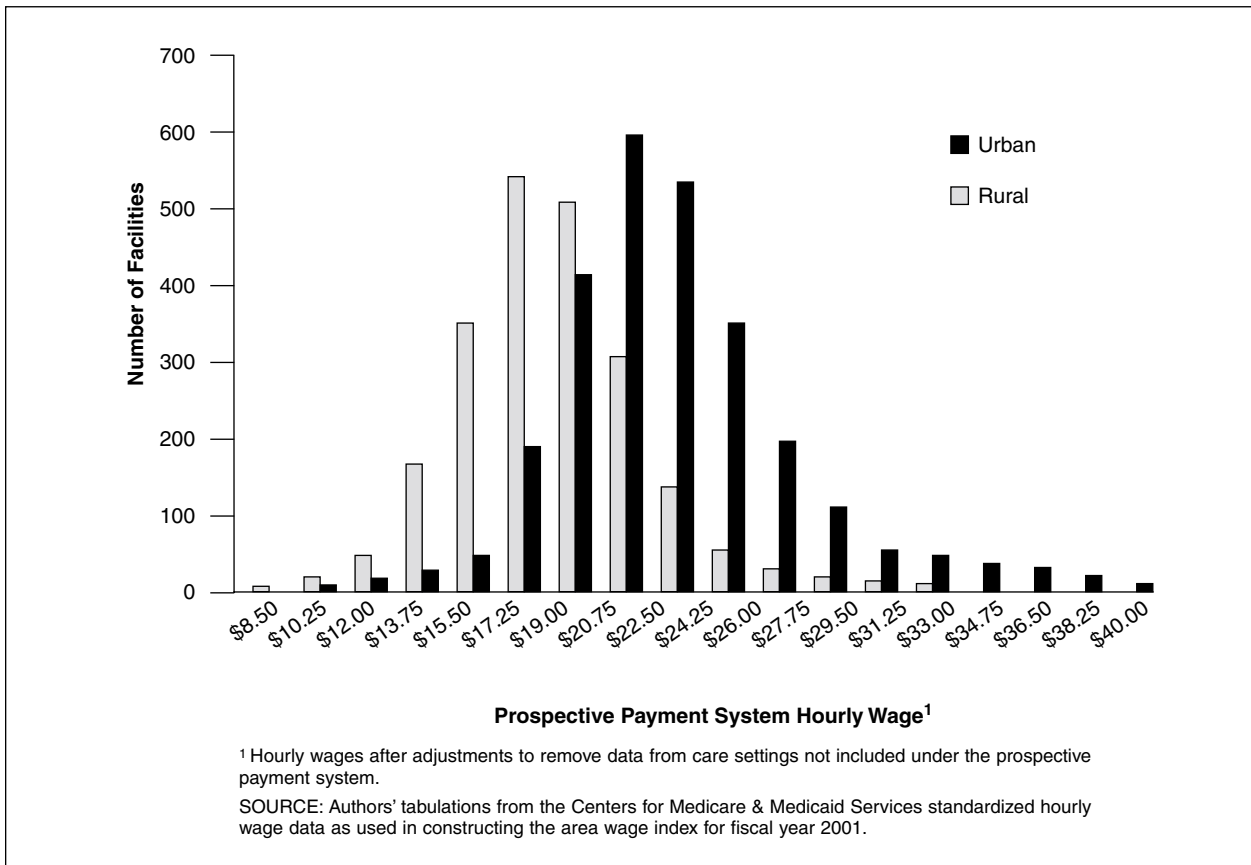
To summarize, three separate deviation statistics have been computed and used at different points in our analyses. The first measures deviation from the geographically assigned market mean. The second measures deviation from the mean within markets defined after regrouping all reclassified hospitals. The third measures deviation from the hybrid—but finally effective—AHW, after applying the hold-harmless provisions.

FINDINGS

Rural-Urban Wage Differentials

In FY 1997 the average reported PPS wage was \$23.20 for hospitals located in central counties of large (population greater than 1 million) MSAs, and \$15.66 for those located very rural counties, where fewer than 2,500 residents live in an urbanized setting. This is a difference of more than 30 percent between the most and the least urbanized settings. In Figure 2 we compare the rural and urban distributions

Figure 2
Distribution of Prospective Payment System Hourly Wage: Fiscal Year 1997



of PPS hourly wages derived from the FY 1997 survey. The mean wage for all rural hospitals was 81 percent of the mean for all urban (although the rural wage index values computed from these figures, and applicable to payments in FY 2001, averaged 84 percent of the values for urban).

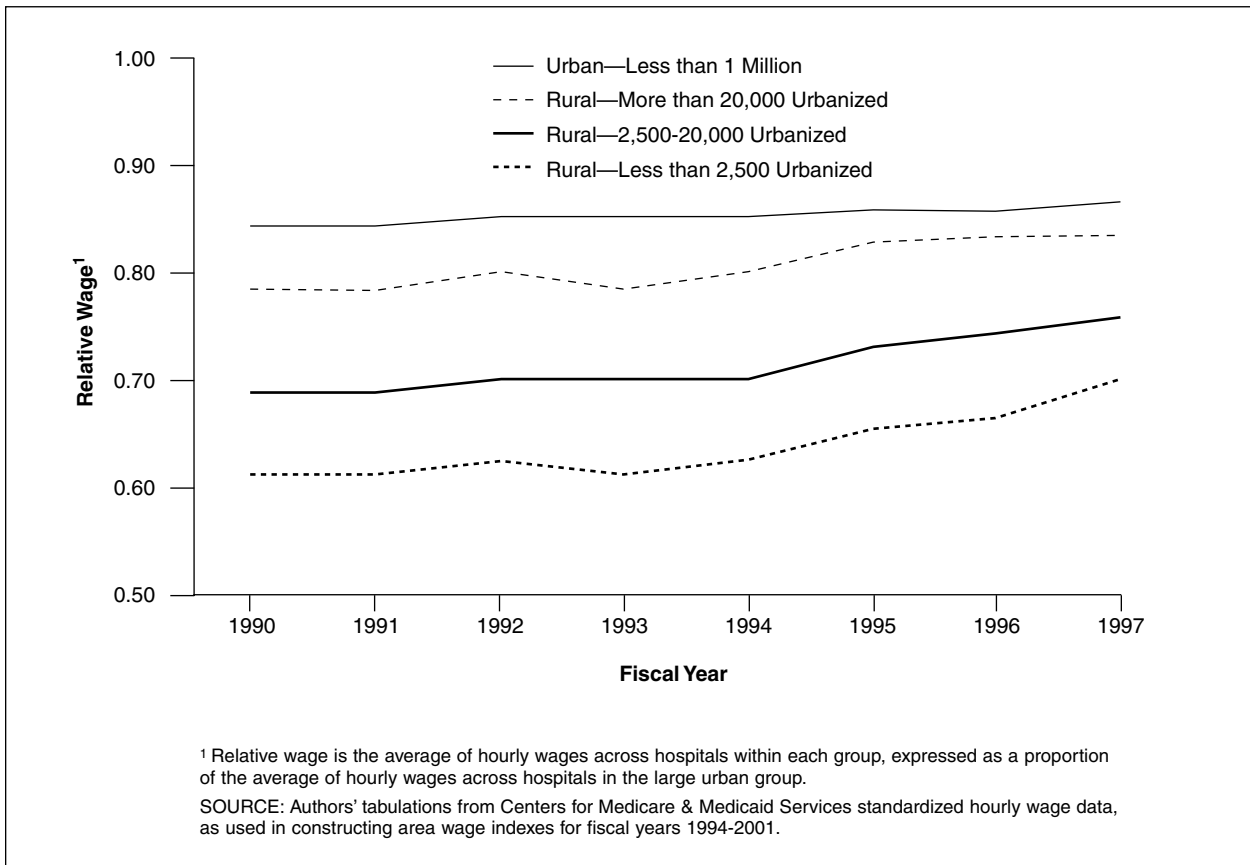
In 1990 the average rural PPS hourly wage was 75 percent of urban average; thus, although the overall rural-urban wage differential is considerable, it has declined over the period covered by this study. Most of the relative wage gains for rural areas occurred after 1995, and proportionally greater changes occurred in the very rural than in the moderately rural areas. This is illustrated in Figure 3, where relative hourly wages are plotted over an 8-year period, for hospitals grouped by the size of the urbanized population. For all

series plotted in this figure, average hourly wages are expressed as a percent of the average that is computed across hospitals located in metropolitan areas with populations of 1 million or greater, within each year. Figure 3 also shows that relative wage improvements have occurred across all types of rural areas, but that similar gains are not seen in hospitals located in smaller urban areas.

How much of this trend in rural PPS wages is due to real relative gains in amounts paid, and how much is due to reporting changes in the CMS survey? To answer this question, we examined similar trends in the raw hourly pay that hospitals take directly from their payroll systems, which ties to the initial total salaries line of the CMS wage survey before any adjustments are made to exclude non-PPS areas

Figure 3

Trends in Relative Wages, by Size of Urbanized Population Within County: Fiscal Years 1990-1997



or to add non-payroll compensation and/or contract labor. We standardized these data within each year to a common period end, but did not adjust them in any other manner. Figure 4 compares the trends of rural hospital raw hourly pay to the final rural PPS hourly wage figures, after expressing both types of rural wages as a proportion of the equivalent average hourly rate reported for all urban hospitals. The trends in Figure 4 suggest that slightly less than one-half of the reduction in the wage differential by 1997 may be due to definitional changes; the rest appears to reflect real differences in the rates of increase in hospital wages paid in rural areas.

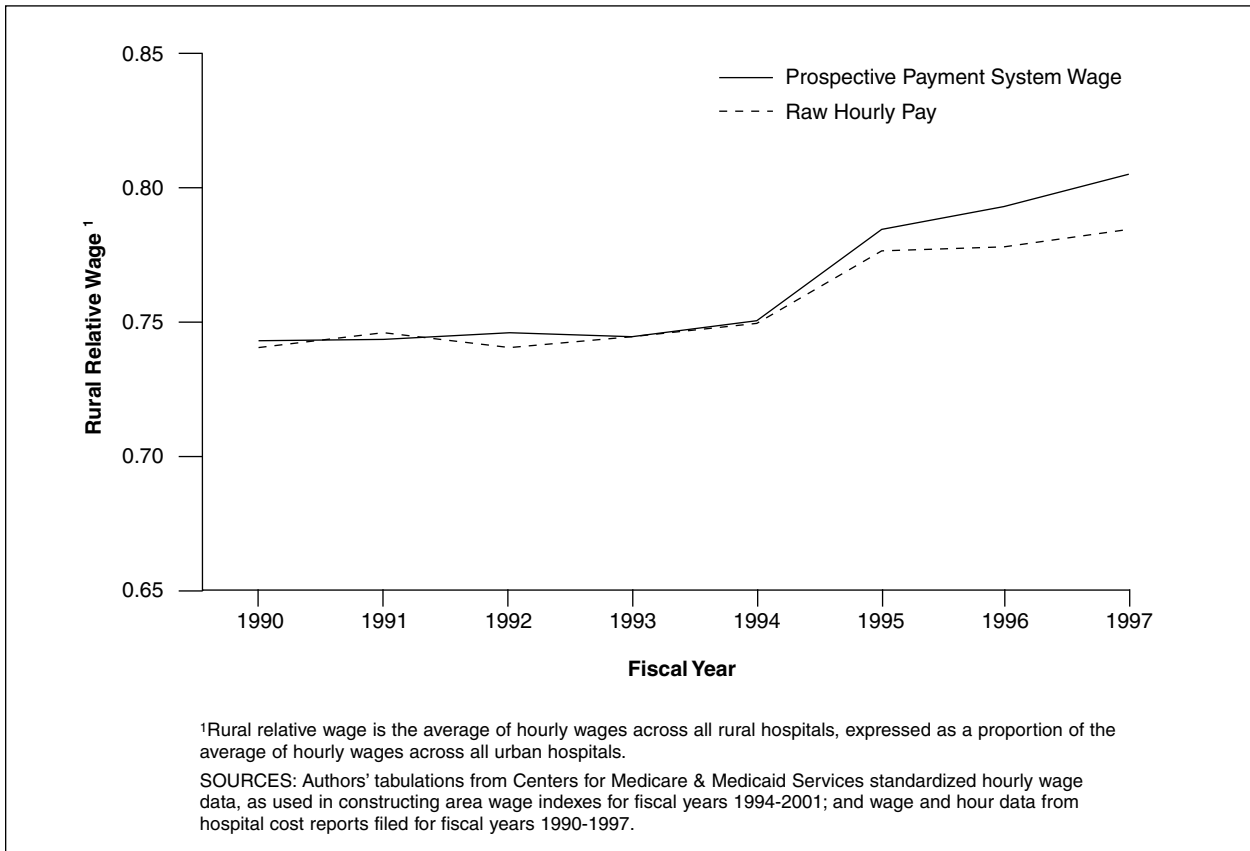
It is also important to identify the extent to which the rural-urban wage differentials may reflect differences in the staffing patterns between large and small hospitals,

rather than differences in the price of labor in urban and rural markets. The average hourly wage of any given hospital is shaped both by the prevailing wage structure of its surrounding community and by the mix of occupations it needs and is able to recruit for its expected level of care. Regardless of location, smaller hospitals tend to use a less highly skilled mix of employees, consistent with their lower average case-mix intensity and lower levels of technology.

Although we cannot observe occupation mix differences directly with the CMS data, we can use bed capacity as a proxy measure. We can then separate the effects of price and occupation mix indirectly, by stratifying the sample by both community size and bed capacity. Rural-urban differentials decrease when this is done, but they are still substantial even when com-

Figure 4

Trends in Rural Relative Wages for Prospective Payment System Hourly Wages Compared to Raw Hourly Pay: Fiscal Years 1990-1997



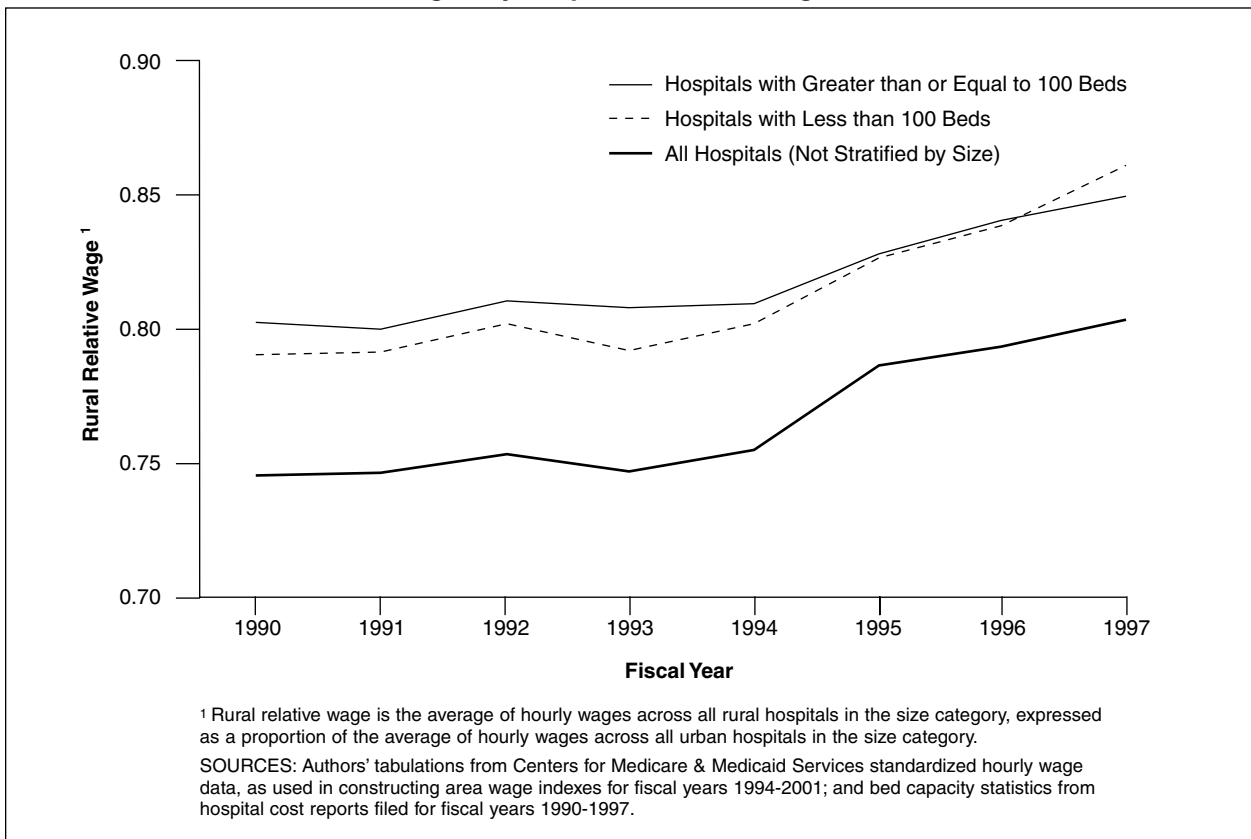
pared within similar sized institutions. In the FY 1997 data, the average PPS hourly wage in rural hospitals with greater than 300 beds was \$19.33, compared with \$22.60 for similar-sized urban hospitals. The mix of occupations should be similar for large hospitals regardless of location, yet there is still an average difference of 14 percent.

Rural-urban wage differences within bed-size categories were present throughout each of the years of our study. In Figure 5 we present mean rural relative wages (average rural PPS hourly wages expressed as a proportion of average urban) where hospitals are divided into groups of those with greater than or equal to 100 beds and those with less than 100 beds. Over the 8-year study period, between one-quarter and one-fifth of the overall rural-urban wage differential

appears to be attributable to factors correlated with hospital size, rather than to market differences in prevailing wages.

A more formal approach to evaluating the independent association between hospital size and average compensation is to add measures of hospital capacity to a regression estimate of hourly wages on the wage index. This provides control for all regional variation captured by the index, rather than just the rural-urban dimension. We constructed dummy variables for each of 10 deciles of the range of hospital acute bed capacity and regressed PPS hourly wages on the wage index plus these indicators, using the smallest hospital group (less than 60 beds) as the reference category. Each of the size indicators was significant ($p < 0.001$) in each year of data. The coefficients on the set of dummy variables

Figure 5
Trends in Rural Relative Wages, by Hospital Bed-Size Categories: Fiscal Years 1990-1997



showed a positive, monotonically increasing effect of size on hourly wages, after controlling for the cross-market differences. In 1997 the coefficient on the wage index was \$19.98; wage increments associated with bed capacity, as estimated by the coefficients on the dummy variables, ranged from \$0.87 in the second lowest group to \$3.28 in the highest group.

ASSESSING WAGE INDEX VALIDITY

Predictive Ability of Index Changes

Definitional changes and regular audits for the wage survey data have improved the precision and reliability of the hourly wage input measure, but such improvements have been accomplished at a cost of

significantly increased hospital reporting burdens. The added administrative costs of both the survey instrument and the geographic reclassification process could be justified if the predictive ability of the wage index has improved as a result of a more precisely measured input. One measure of validity for the wage index is its ability to predict wages at the hospital level. For the reporting changes to improve the index in this regard they need to have reduced variation at the market level, because predictive ability in the wage index is primarily a function of within-market homogeneity. Standard analysis of variance techniques were used in some of the earliest evaluations of the wage index (De Lew, 1992) and they are still a good approach to testing for improvement over time.

We regressed individual hospitals' PPS hourly wage figures against the final wage index values that were developed from those same figures. Because each year's index is constructed with data collected from a period 4 years earlier, we matched the independent variable (the wage index value assigned to each hospital) to the dependent variable (PPS hourly wages) from the period 4 years earlier. No clear pattern of improvement can be identified in the percent of variance explained over the 8-year study period. If anything, there is a trend in the opposite direction—from FYs 1990 to 1994 the index explained between 73 and 74 percent of the variation in hospital wages, but in 1996 it only explained 67 percent, and in 1997 only 65 percent. Despite the many improvements made in the measurement of hourly wages, the labor markets as defined for the index appear to have become more heterogeneous with respect to average hourly PPS wages, not less.

When we ran the regression separately for rural and for urban facilities, we found the index performs substantially worse as a predictor for rural than for urban hospitals, in each year. The rural labor markets are larger than their urban counterparts both geographically and in terms of the number of hospitals per market, and they show greater variability in hourly wages. The number of unique labor markets varies slightly from year to year but our sample included 48 rural and 217 urban markets in FY 1997, of which 29 urban markets contained only 1 PPS hospital. The national coefficient of variation in the PPS hourly wages (standard deviation expressed as percent of the mean, computed across all hospitals in the sample for each year) did decline from 24 percent in 1993 to 21 percent in 1997. This is consistent with a reduction in the rural-urban wage differential. Yet when market-specific

coefficients of variation are computed there is little evidence of reduction in variance within rural or urban markets, over time, whether they are defined geographically or post-reclassification.

Reporting Delay Effects

The same analysis of variance technique can be used to assess the effects of the 4-year data lag. The percent of variance in current period hourly wages that is explained by the index applicable to payments in the current period (that was constructed with 4-year-old data) can be compared to that explained by index values constructed with contemporaneous data (that will be applied to payments 4 years later). If the index that is applicable to the current period explained substantially less of the current period variation, this would be evidence that moving toward more timely data acquisition could produce a more equitable wage adjuster. We did not, however, find a strong case for this argument. As summarized in Table 2, after MGCRB reclassifications were introduced in 1992, there is increasingly little difference in the predictive abilities of the index from either period. The 1993 wage index (based on 1989 data) explains 71.5 percent of the variation in 1993 hourly wages, whereas the 1997 wage index (based on 1993 data) explains 74.1 percent of the variation in 1993 hourly wages, a difference of 2.6 percent points. By 1997, the improvement in predictive ability between the indexes is only 1.2 percent points.

This is not to say that significant year-to-year changes in average wage levels do not occur at the individual hospital level, or that MSAs containing only one or two hospitals might not experience temporary distortions in their relative wages under the 4-year data lag now in place. Most urban and all rural labor markets contain multiple hospitals, and significant changes in relative

Table 2

Area Wage Index as a Predictor of Prospective Payment System Hourly Wages: Fiscal Years 1990-1997

Where outcome variable is Prospective Payment System hourly wages in year (<i>t</i>)	Variance explained (<i>R</i> ²) by the area wage index	
	from year (<i>t</i>)	from year (<i>t</i> +4)
	Percent	
1990	64.2	72.4
1991	69.4	73.7
1992	70.5	72.7
1993	71.5	74.1
1994	70.8	73.7
1995	66.0	69.2
1996	65.3	68.2
1997	63.6	64.8

SOURCE: Author's tabulations from the Centers for Medicare & Medicaid Services standardized hourly wage data, as used in constructing area wage indexes for fiscal years 1994-2001.

PPS hourly wages would have to occur widely within a given market for the lag in the wage data to translate into a problem in the variance explained by the older index. It is possible to imagine a scenario where this could present a problem for specific areas, in particular, where localized labor shortages either occur or are alleviated, causing a market-specific change in hiring practices. These do not appear to have been a problem during the period that we have analyzed.

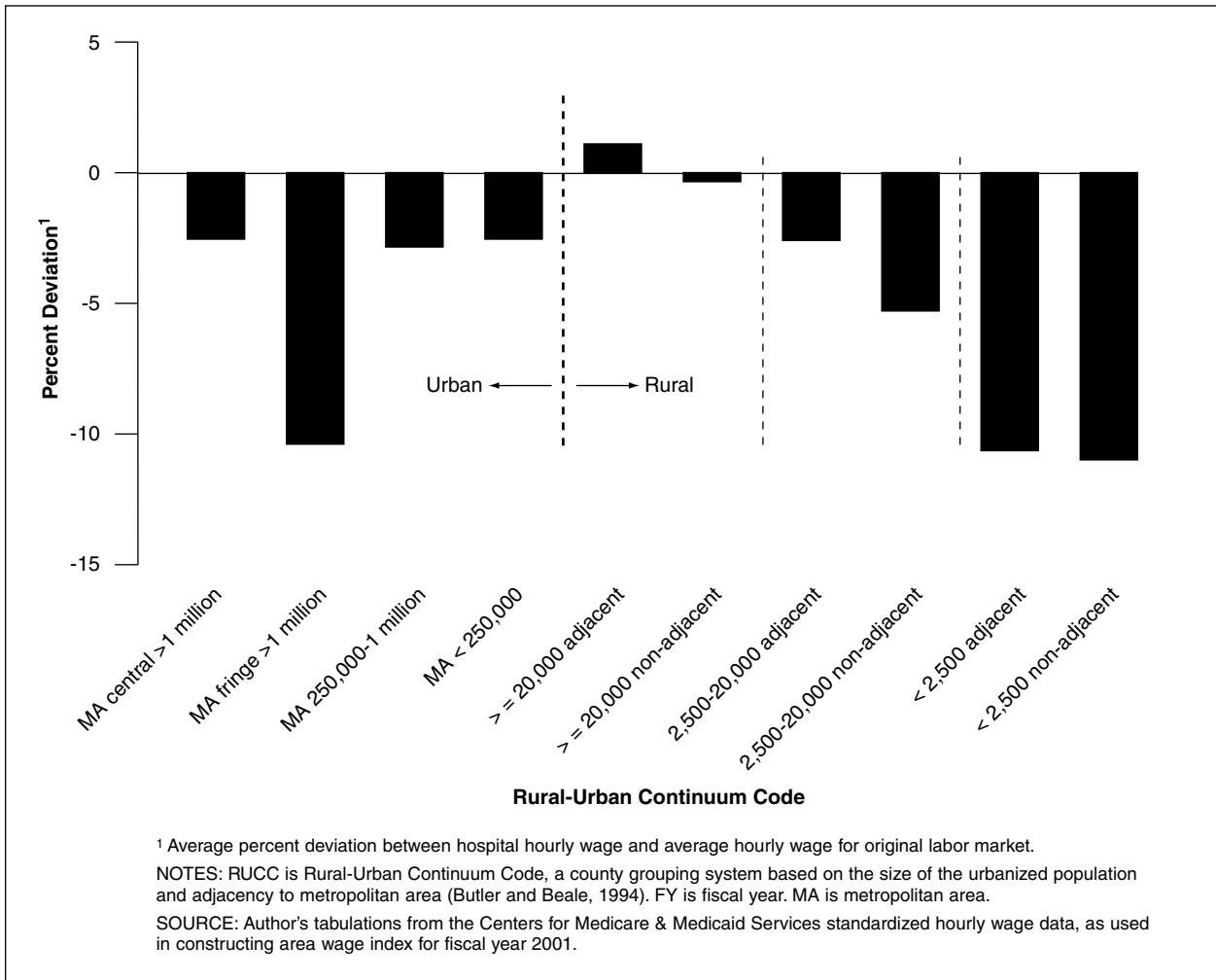
The predictive ability of the index is a function of within-market homogeneity, and is therefore most sensitive to labor market definitions. The technique of comparing explained variance cannot capture the impact of a secular trend across markets, such as the reduction in the rural-urban wage differential. As previously noted, the gap between average rural and urban PPS wages began to decrease after 1995, and as long as this trend continues, rural hospitals would benefit from timelier acquisition and application of wage data. The advantage to more timely data acquisition belongs, however, to whichever group of labor markets is experiencing relatively faster growth in average wages, and this, too, is likely to change over time.

Analyzing Within-Market Variation

We are most interested in identifying systematic patterns in within-market variation—particularly patterns that are attributable to geographic characteristics such as community size or proximity to urban areas—because such patterns would indicate the presence of multiple labor markets inappropriately grouped as one. Figure 6 summarizes the average percent deviation of individual hospitals' hourly wages from the AHW of the labor markets to which they were initially assigned in FY 1997, based on county location. The averages are computed across hospitals that have been grouped according to their RUCC. The predominantly negative bars in this figure reflect the characteristic previously noted, that the AHW is a weighted average where the larger, higher-wage hospitals have greater influence than do the smaller ones, such that a greater number of smaller, lower-wage hospitals fall below the weighted mean.

Figure 6 reveals two urban and three rural within-market groups that strongly suggest the presence of submarkets. One-way analysis of variance by RUCC confirms that significant differences exist between groups identified by the size of their urban-

Figure 6
Within-Market Wage Deviation Averaged Across Hospitals, by RUCC: FY 1997



ized populations, but not by adjacency to urban areas. The urban submarkets are not a focus of this study. It is, however, worth noting that although there is a distinct difference in the wage variation between the central and the fringe (or suburban) counties of large MSAs, there were only 157 hospitals located in these fringe counties in 1997 out of a total of nearly 2,700 urban hospitals.

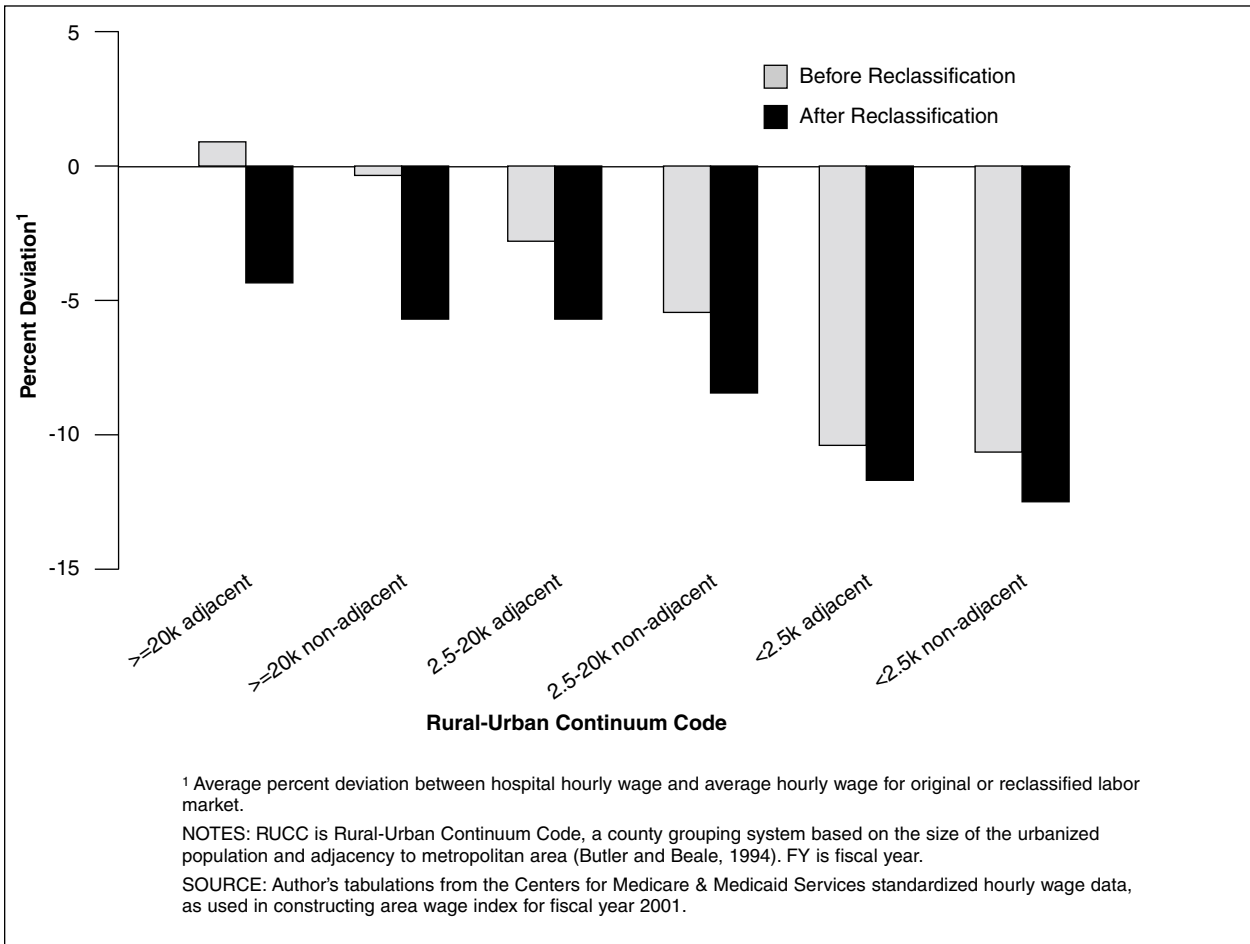
Figure 6 is drawn from 1997 data, but the same pattern is evident of wage variation over each of the years covered by this study. The results are similar to earlier findings in studies conducted for CMS and for ProPAC, from hourly wage data collect-

ed as far back as 1984 (Cromwell, Hendricks, and Pope, 1986; Prospective Payment Assessment Commission, 1987). They are also consistent with conclusions of De Lew (1992), who found that an alternative index constructed with multiple rural markets based on adjacency criteria performed no better in predicting hospital-level wages than one constructed from State-level aggregates, while one that distinguished multiple rural markets based on town size showed substantial improvement.

The definition of single rural labor markets at the State level has the effect of aggregating multiple markets under one payment

Figure 7

Rural Within-Market Wage Deviation, by RUCC Before and After Geographic Reclassification: FY 1997



adjuster per State. The group that is put at a disadvantage from this aggregation is the barely rural group—in this study, the set of hospitals located in counties with urbanized populations in excess of 20,000. This is also, however, the group most likely to qualify for a reclassification to a neighboring labor market. In FYs 1996 and 1997 reclassifications were approved for 25-30 percent of hospitals in these barely rural categories and 10-12 percent of hospitals in the moderately rural categories (located in counties with urbanized populations of 2,500 to 20,000). Figure 7 compares the deviation measures before and after accounting for all aspects of geographic reclassification, including the hold-harmless protections, for hospitals located in non-metropolitan RUCC groups only.

After regrouping the hospitals to account for reclassification there is little difference between the wage patterns of the two larger categories of rural counties. Among hospitals that continue to be assigned the rural wage index values, there is still evidence of two distinct rural submarkets. The differences in mean deviation values across the four larger rural categories are reduced—though some are still statistically significant, they are probably not policy significant. The differences between the two most rural categories and the other RUCC groups, however, are significant and have been made more pronounced by reclassification.

It is important to recognize that the existence of the remaining two submarkets works in favor of hospitals in the smallest

Table 3

Percent Deviation of Hospital Hourly Wage from Market AHW, by Reclassification Status of Labor Market: FY 1997 Wages for the FY 2001 Area Wage Index

Rural RUCC Group	Original Rural Market ¹	Reclassified Rural Market ²	
		Before accounting for hold-harmless provisions	After accounting for hold-harmless provisions
Percent			
More than 20,000 Urbanized Population, Adjacent	1.3	-1.1	-4.5
More than 20,000 Urbanized Population, Not Adjacent	-0.1	-1.5	-5.8
2,500-20,000 Urbanized Population, Adjacent	-2.9	-2.3	-5.8
2,500-20,000 Urbanized Population, Not Adjacent	-5.3	-3.7	-7.6
Less than 2,500 Urbanized Population, Adjacent	-10.5	-9.9	-12.2
Less than 2,500 Urbanized Population, Not Adjacent	-11.1	-9.0	-12.6

¹ Group includes all hospitals in non-metropolitan counties.

² Group includes only those rural hospitals that are not reclassified to metropolitan areas.

NOTES: AHW is average hourly wage for the labor market. FY is fiscal year. RUCC is Rural-Urban Continuum Code, a county grouping system based on the size of the urbanized population and adjacency to metropolitan area (Butler and Beale, 1994). Percents are unweighted averages computed across all hospitals within the RUCC group.

SOURCE: Author's tabulations from the Centers for Medicare & Medicaid Services standardized hourly wage data, as used in constructing area wage index for FY 2001.

and most isolated communities, where the PPS hourly wages averaged nearly 13 percent below the weighted averages of their assigned labor markets in FY 1997. The wage index values assigned to these hospitals in FY 2001, while below the national average, are still higher than they would have been in a more precisely defined labor market.

What do negative deviation statistics mean in the larger context of PPS inpatient margins? From the perspective of a provider wanting to maximize Medicare margins, negative is good. If a hospital's own hourly wage is below the average within its assigned labor market, then the wage index value for that labor market reflects an average input cost that is higher than the hospital's actual input costs. Holding other production factors constant, the hospital's payment per DRG-weighted case will therefore be relatively favorable. If, instead of using single statewide rural aggregates, the labor markets were defined by grouping non-MSA counties into three or even two levels of rural labor markets within State, based on community size, this could reduce or eliminate the need for reclassification. It might improve

payment equity for some hospitals in the higher-wage rural markets that are not now eligible for reclassification. The change would also, however, lower PPS payments to the hospitals located in the smallest and most rural communities, because the AHW for the more rural subgroup(s) would be lower, and the average deviation measures by subgroup would be smaller (that is, less negative).

The hold-harmless provisions have the effect of allowing all rural market AHWs to be computed as though there were no geographic reclassifications, giving each rural wage index market the benefit of the higher wage hospitals that have reclassified into other labor markets. We find that these provisions are at least as influential in the findings shown in Figure 7 as the reclassifications themselves. For example, where PPS wages in the most rural RUCC group averaged 13 percent below their market-level AHWs computed according to the hold-harmless rules, they would have averaged 9 percent below the AHWs if these had been computed using only the non-reclassified rural hospitals. Table 3 provides a comparison of separate average deviation statistics using weighted market

mean hourly wages computed first by original geographic markets, then by reclassified markets without the hold-harmless provisions, and then by the synthetic market average imputed from the index after applying the hold-harmless provisions. The hold-harmless rules provide the most substantial protection to non-reclassified hospitals in the larger rural areas, but the payment advantages from this protection are also felt by those in very rural areas.

DISCUSSION AND CONCLUSIONS

Differences in CMS's wage index values result from real differences in labor costs, which, to the extent that they reflect external market conditions, form an appropriate basis on which to adjust the PPS rates. The findings from this study provide little evidence to conclude that rural facilities are systematically disadvantaged by the aggregated rural labor markets, if the standard for evaluating its impact is based on payments relative to expected cost. State level rural markets are unable to distinguish between identifiable submarkets in larger versus smaller rural communities. These submarkets suggests that there are systematic differences in within-market wage patterns that derive from external factors, that is, factors outside the control of hospital decisionmakers. The accuracy of rural labor market definition is improved by the MGCRB decisions, in that the number of identifiable rural submarkets is reduced. Our findings indicate that the administrative exceptions process has been a successful correction tool for market misclassification in the moderately urbanized non-MSA areas. The hold-harmless provisions, on the other hand—while protecting the wage-related payments of non-reclassified hospitals—actually add to the distortion in the index, as they make the within-market deviation from the AHW

more negative than it would be in the absence of such provisions. It is possible that the hold-harmless provisions contributed to the declining predictive ability of the wage index over time. The hold-harmless provisions are more accurately viewed as another targeted policy adjustment in the PPS rates, and not as part of a technical correction to the index.

This study does not directly address the issue of whether or not the index should be standardized for the effects of occupational mix differences. Whether a cost index is inherently less equitable than a pure price index as a PPS rate adjuster is a complicated question, in part because of the positive correlation between case mix and the price of labor. Systematic differences in occupation mix between rural and urban markets may reflect expected differences in services delivered, case mix and patient severity as much or even more than providers' incentives to choose the most efficient skill mix. Relationships between case mix, skill levels, and the price of labor are complex and deserve further quantitative analyses, particularly now that the Benefits Improvement and Protection Act of 2000 has mandated that some occupation-specific data will be collected on the annual wage surveys.

Our findings lead us to conclude that the area wage index for PPS hospitals functions reasonably well for the purposes for which it was designed, if we accept the premise that adjustment for regional variation in the cost (rather than pure price) of labor is valid. From our comparisons of the time trends in raw hourly pay and the adjusted PPS hourly wages, it appears that much of the difference between average rural and urban hospital wages in earlier years may have been due to imprecise measurement on the surveys. Over the study period the wage index has improved in its control for variation across hospitals

in the reporting of benefits, in the mix of PPS to non-PPS employees, and in the use of contract labor. We have demonstrated that these changes reduced the urban-rural PPS wage differential, but they have also improved the index by reducing the influence of factors unrelated to pure price differences.

We find no evidence that the low index values that are typically computed for rural markets represent an understatement of the true relative cost of labor in rural areas. If anything, the opposite is true; the retention of statewide rural labor markets in conjunction with the hold-harmless provisions overstates the relative labor costs for the most isolated, rural areas. If there are concerns over the share of PPS payments going to rural hospitals, the rural Medicare margins or the financial condition of rural hospitals in general, then altering the calculation of the wage index is probably not an appropriate way to address them, because the wage index itself does not appear to be the source of the problem.

There is one way in which Medicare margins could be sensitive to the wage index, and that is through the assignment of an appropriate labor-related share of the PPS standard rate. If the labor-related share is either over or understated, payment inequities will result regardless of the accuracy of the wage index. No matter what the true labor related share of hospital costs is, the mechanics of the payment computation are such that a lower labor-related percent will raise the Medicare margins of any hospital in a market with an index below 1, and a higher percent will raise the margins of those located in markets where the index is above 1. The current labor share (now set by CMS at 71 percent) is derived from a subset of the weights for components to the hospital

input price index, and the same share is applied to all hospitals, across all regions. The appropriateness of this practice has not been thoroughly investigated in the literature, but it should be tested through more detailed analyses of average cost functions within groups of hospitals.

One final policy consideration to be drawn from our study is that the application of the hospital area wage index to other PPS rates without the benefit of geographic reclassifications is problematic. The use of hospital wage index to adjust non-hospital rates is intended to be an interim measure while CMS examines industry-specific wage data for skilled nursing facilities, but it may be a permanent feature of the PPS for home health, inpatient rehabilitation and other non-acute services (*Federal Register*, 2000a, b; 2001). Because reclassifications are generally granted for individual institutions rather than geographic areas, expanding MGCRB decisions to non-hospital providers could be administratively complex. Nevertheless, if hospital relative wages are thought to be a reasonable proxy for relative wages faced by providers in other sectors, it is difficult to argue that our findings regarding the importance of reclassification as a correction tool should not apply equally to other types providers. Nor, in the event that a separate wage index is developed for skilled nursing facility rates, does it seem likely that the same rural submarkets that have been identified in this and earlier studies, would not also be present in the long-term care industry.

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TECHNICAL NOTE

The following is a description of the categories that we used for Federal fiscal years 1990-1997; the numbers indicate the percent of study hospitals that were located in each geographic category.

	Percent
URBAN (4 Levels): Counties within MSAs:	
• Central county location, population greater than 1 million	27
• Fringe (suburban) county location, population greater than 1 million	3
• Population 250,000 - 1 million	17
• Population less than 250,000	8
RURAL (6 Levels): Counties not within MSAs:	
• Greater than 20,000 living in urbanized setting	
Adjacent to MSA	5
Not adjacent to MSA	4
• Between 2,500 and 20,000 living in urbanized setting	
Adjacent to MSA	13
Not adjacent to MSA	15
• Less than 2,500 living in urbanized setting	
Adjacent to MSA	2
Not adjacent to MSA	6
	<hr/>
Total	100