Potential Refinements to Medicare's Wage Indexes for Hospitals and Other Sectors

A study conducted by staff from RTI International for the Medicare Payment Advisory Commission

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June 2007 • No. 07–3

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Final Report

Prepared for

Medicare Payment Advisory Commission
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EXECUTIVE SUMMARY

ES.1 Scope of This Report

As part of its examination of alternatives to the current Medicare area hospital wage index adjustment, the Medicare Payment Advisory Commission (MedPAC) contracted with RTI International to analyze certain issues in the current wage index and its proposed alternative wage index. RTI's scope of work for this contract included the following:

- Document the history of the current wage index and the resulting exceptions.
- Present the theoretical arguments for and against the current wage index and the proposed alternative.
- Document what wage indexes are used in the other Medicare prospective payment systems and the advantages and disadvantages of using the pre–floor, pre–reclassification hospital wage index for other settings.
- Analyze the quality and characteristics of the data underlying the current and alternative wage indexes (including the volatility of both indexes, and the volatility of indexes of wages only, benefits only, and total compensation).
- Identify trends and regional variation in the ratio of benefits to total compensation.

ES.2 Organization of This Report

This report is organized in four sections. In Section 1, we provide a review of the legislative and regulatory history of wage index. We trace major CMS regulatory and congressionally mandated changes that were implemented between 1984 and 2007, including: the history of the wage data sources; the processes implemented for assigning hospitals to labor markets; attempts to standardize the wage index for occupation mix differences; and remaining special exceptions and adjustments that have been imposed over the years. Also in Section 1, we use hospital–level data from the FY 2007 final wage index implementation to identify the number of facilities eligible and/or covered under initial rules, reclassifications, exceptions and other adjustments.

In Section 2 we discuss selected issues in the two alternative approaches to constructing the Medicare hospital wage index, using the CMS survey of hospital wages or BLS all–industry wage data. These include how Medicare’s and MedPAC's approaches are related to theoretical wage indexes; the theory and empirical evidence on competitive wage setting and inter–industry wage differentials, and implications for the hospital wage index; empirical analysis using BLS data of national differences in wages by industry; the industry composition of the MedPAC BLS wage index; a summary of earlier research RTI staff did for CMS on the factors that impact average hospital wages; and arguments for and against the use of hospital–specific versus all–industry wage data in the hospital wage index.

In Section 3, we discuss issues with using the area hospital wage index to adjust payments in several other institutional payment settings such as skilled nursing facilities and inpatient rehabilitation facilities.

In Section 4, we compare the volatility of wage indexes based on the CMS hospital wage survey data and an index constructed from the BLS all–industry wages for hospital occupations. We discuss possible sources of volatility and data quality issues, including a comparison of the volatility of indexes of wages, benefits, and total compensation. Section 4 also contains results on geographic and temporal variation in benefits as a proportion of total compensation.

ES.3 Summary of Key Findings

Section 1

- Nearly four of every ten PPS hospitals has some sort of exception. Thirty–nine percent of all rural facilities and 17 percent of all urban facilities have some sort of reclassification. Ten percent of urban providers are located in MSAs subject to the rural floor provisions or to the imputed rural floors. Outmigration adjustments increase the index values for two percent of urban PPS providers (133 hospitals) but nine percent of rural ones (90 hospitals). The size of the adjustments averages 1.3 percent across qualifying urban counties but 3.4 percent across qualifying rural ones.

Section 2

- The use of the Laspeyres (fixed weight) functional form for the hospital wage index is reasonable.

- With competitive labor markets, the area all–industry wage for an occupation should accurately represent the area cost of labor to hospitals.

- Inter–industry wage differentials have been observed, but the reasons for their existence, and whether they are consistent with competitive wage setting theories, are controversial.

- On a national basis, hospital wages by occupation are similar to all–industry wages. But hospitals pay different wages than some other specific industries nationally.

- The MedPAC BLS wage index can be interpreted as a blend of a hospital–specific wage index (one–third weight) and a non–hospital wage index (two–thirds weight).

- Many factors have been shown to affect area hospital average wages, including area opportunity wages; area hospital–specific wages; hospital size, casemix, occupation mix, and unionization; and the competitiveness of the area labor market.

- The major argument for using hospital–specific wages in the Medicare hospital wage index is to reflect appropriate hospital–specific labor–market factors. The major arguments for using all–industry wages are to avoid circularity in payment, avoid

noncompetitive and idiosyncratic factors in hospital wage setting, and measure wages more accurately using a broader sample of workers.

Section 3

- The major drawbacks to using acute care hospital relative wages as adjusters for non–hospital health care payments are that (1) acute care area wage differences may be influenced by differences in occupation mix that are not applicable to other settings; (2) there are many markets, including even some state rural markets, where the hospital index values are computed from data submitted by only one or two facilities; and (3) non–hospital providers to which the hospital wage index is applied may be located in counties without hospitals, hence their wage index is based on wage data that are not specific to the area in which they are located.

Section 4

- A wage index constructed from BLS all–industry wage data is somewhat less volatile than a published wage index based on the CMS survey of hospital wages.
  - For approximately 250 MSAs from 2000 to 2004, 1.3 percent of MSA/year changes in the CMS wage index were 10 percent or greater, compared to 0.9 percent for the BLS index. Similarly, 8.8 percent of the CMS changes were 5 to 10 percent, while only 4.8 percent of the BLS changes were as large. Over 80 percent of the BLS index MSA/year changes were smaller than 2.5 percent, compared to less than 65 percent of the CMS index changes.
  - The average annual absolute percentage change for approximately 250 MSAs from 2000 to 2004 was 2.3 percent for the CMS index versus 1.7 percent for the BLS index.
  - The average standard deviation of MSA wage indexes from 1999 to 2004 was 1.8 percent for the index based on BLS data versus 2.4 percent for the index based on CMS wage survey data.
- The inclusion of benefits in the CMS wage index does not explain why the CMS wage index is more volatile than the BLS wage index (which does not include benefits).
- The hospital Medicare Cost Report data show a clear increase in reported benefits as a percentage of total compensation from 1999 to 2004, that occurred in both rural and urban areas, and across all regions. Across markets, the mean value of benefits as a proportion of total hourly compensation rose from 16.7 percent in 1999 to 19.7 in 2004.
- The BLS Employer Cost for Employee Compensation series shows a slight increase in benefits on a share of total compensation for hospital workers between 1993 and 2004. The BLS series also shows an increase in the share of benefits after 2004.

- In 2004, benefits were a lower percentage of total compensation in the South than in other regions according to the Medicare Cost Report hospital survey data. Excluding benefits from the Medicare hospital wage index would therefore overstate relative total compensation costs in the South relative to other regions (i.e., would benefit the South at the expense of other regions).

1.0 HISTORY OF THE CURRENT CMS INPATIENT PROSPECTIVE PAYMENT SYSTEM HOSPITAL WAGE INDEX

1.1 Background

The hospital area wage index is used to adjust institutional payment rates for geographic variation in labor costs under several of Medicare's prospective payment systems (PPS). The area wage index has been a part of the inpatient PPS rate structure since that payment system was first implemented in 1983. Since 1997 the hospital wage index has also been applied to PPS payments for hospital outpatient services, home health agencies, skilled nursing facilities, inpatient psychiatric facilities, inpatient rehabilitation facilities and long–term acute care hospitals.

Section 1886 (d) (3) (E) of the Social Security Act requires that, as part of the method for determining prospective payments to hospitals, the Secretary must adjust standardized payment amounts "for area differences in hospital wage levels by a factor reflecting the relative hospital wage level in the geographic area of the hospital compared to the national average hospital wage level". Area wage adjustments to prospective rates are required to be budget neutral, such that total national payments after applying the wage index are the same as they would be in the absence of a wage index.

Although the Secretary was initially given broad discretion with respect both to the type and source of data used for wage standardization and to the definition of geographic areas, Congress has intervened on several occasions to direct specific modifications or exceptions to computation and application of the wage index. While the data sources have changed several times over the past two decades, the geographic areas (or "labor markets") used in the construction of the area wage index have always been defined on the basis of metropolitan statistical areas (MSAs) as established by the Office of Management and Budget (OMB), with state–level aggregates of non–metropolitan areas used to define rural markets. Over time, however, several exceptions have been developed for alternate market assignments.

Under each prospective payment system the wage index is used to adjust a portion of the base payment rate per unit of service that is referred to as the "labor–related share" of payments. The labor related share is a sector–specific factor also set by the Secretary and can range from as low as 46 percent in ambulatory surgery centers to nearly 80 percent for nursing homes. Over the years the wage index values for specific markets have ranged from lows close to 0.70 to highs of over 1.60. With such a potentially powerful influence over the distribution of Medicare payments, the index came under close scrutiny in the early years following hospital PPS implementation, and again in the late 1990s through the early 2000s following PPS expansion into other care settings. Several evaluations of the wage index were conducted for and by CMS and the Prospective Payment Assessment Commission (ProPAC) (Cromwell, Hendricks and Pope 1986; ProPAC 1987, 1991, 1993; Williams, Pettengill, and Lisk 1990; Wright and Marlor 1990; Williams 1991). The index is perceived as having a powerful effect on the distribution of Medicare payments between rural and urban areas, and has also come under close scrutiny by rural policy analysts (Dalton and Slifkin, 2002, Wellever 2000). As documented by the legislative history in ***Table 1***, Congress has often intervened to alter the area wage adjustments

under prospective payment, mandating changes in the source data, in the index computation methods and in the rules governing labor market assignments.

Table 1
Legislative History of the Hospital Area Wage Index

Legislative Act	Section/P.L. No.	Effect on Wage Index
Social Security Act of 1983	P.L. 98–21 Section 1886(d)(3)(E)	Initial inpatient PPS legislation. Established a wage index to adjust the standardized amounts "for area differences in hospital wage levels by a factor (established by the Secretary) reflecting the relative hospital wage level in the geographic area of the hospital compared to the national average hospital wage level."
Title VI of the Social Security Amendments of 1983	Section 601 (H)	Legislated a change in the labor–related share of standardized payment to be adjusted by wage index, and directed Secretary to make periodic updates
Deficit Reduction Act of 1984	P.L. 98–369 Section 2316	Directed Secretary to develop new wage index controlling for full and part–time wages (effectively mandating move from BLS to CMS wage data–see Table 4 for a comparison of the old 1984 BLS survey and the new BLS survey that MedPAC is proposing).
Consolidated Omnibus Budget Reconciliation Act of 1985	P.L. 99–272 Section 9103	Delayed implementation of index from 1982 survey data
Omnibus Budget Reconciliation Act of 1987 (OBRA 1987)	P.L. 100–203 Section 4005(a)	Introduced "deemed urban" counties (new section 1886(d)(8)(B)) for counties adjacent to MSAs meeting certain worker commuting patterns ("Lugar counties").
Technical and Miscellaneous Revenue Act of 1988	P.L. 100–647 Section 8403(a)	Directed the wage index for those rural counties with hospitals that were deemed urban and that are affected by the recomputation from P.L. 100–203 to be calculated separately. ("Deemed urban" counties otherwise resulted in the reduction of the wage index values for several MSAs and rural areas).
Omnibus Budget Reconciliation Act of 1989 (OBRA 1989)	P.L. 101–239 Section 6003(h)	Created the Medicare Geographic Classification Review Board (MGCRB) and set for criteria for reclassification of hospitals. Required that wage indexes be updated annually beginning FY 1994 (after October 1, 1993). Limited the potential negative impact from reclassifications to 1 percent or less, in market to which facilities are reclassified.
Omnibus Budget Reconciliation Act of 1990 (OBRA 1990)	P.L. 101–508 Section 4002(h)	Limited the effects of redesignation on index values for non–redesignated facilities in urban markets being reclassified into and for markets being reclassified out of. Index values for all rural markets cannot be reduced by reclassification
Omnibus Budget Reconciliation Act of 1993	P.L. 103–66 Section 13501(b)	Prevented a reduction in the wage index for an urban area where index value is below the state rural value
Medicare, Medicaid, and Children's Health Provisions of the Balanced Budget Act of 1997 (BBA)	P.L. 105–33 Section 4410	Establishes rural floors (urban index values to be set no lower than state rural value)
Balanced Budget Refinement Act of 1999 (BBRA)	P.L. 106–113 Section 401	Permitted an urban hospital to apply to be treated as being located in the rural area of a State in which the hospital is located (urban to rural reclassification).
Medicare, Medicaid, and SCHIP Benefits Improvement and Protection Act of 2000 (BIPA)	P.L. 106–554 Section 304	Mandates occupational mix data collection and implementation of adjustment to the hospital wage index beginning October 1, 2004. Allows a statewide entity to apply for reclassification for a statewide wage index. Permits an urban hospital, separate from the MGCRB, to apply to be treated as being in the rural area of the State
Medicare Prescription Drug, Improvement, and Modernization Act of 2003 (MMA)	P.L. 108–173 Section 505; Section 508	"Wage Index Reclassification Reform:" 508 exemptions; Outmigration adjustments; One–time appeals process for MGCRB decision
The Tax Relief and Health Care Act of 2006	P.L. 109–432 Section 106	Extended Section 508 reclassifications Mandated MedPAC study of alternative wage indexes Directed Secretary to implement changes in wage index

SOURCE: RTI Synopsis of Federal Registers.

In the following sections we provide a review of the legislative and regulatory history of wage index. We trace major CMS regulatory and congressionally mandated changes that were implemented between 1984 and 2007. At the end of the section, ***Table 3*** also provides a chronologic summary in table form. The section is organized as follows: Section 1.2 describes the history of the wage data sources; Section 1.3 follows the processes implemented for assigning hospitals to labor markets; Section 1.4 discusses attempts to standardize the wage index for occupation mix differences; and Section 1.5 describes remaining special exceptions and adjustments that have been imposed over the years. Finally in Section 1.6, we use hospital–level data from the FY 2007 final wage index implementation to place the history of the wage index in context by identifying the number of facilities eligible and/or covered under initial rules, reclassifications, exceptions and other adjustments.

1.2 Hourly Wage Data Sources

1.2.1 Original BLS Data

The initial hospital wage index was created from data supplied by the Bureau of Labor Statistics (BLS) using its 1981 Employment, Wages, and Contribution File (Federal Register, 1983, p. 39765). The BLS series reported average wages per hospital worker, taken from the quarterly reports filed to state employment security agencies by all non–federal hospitals. Quarterly data on total covered hospital wages and total covered workers were reported at the county level, aggregated to CMS' defined labor markets and used to compute aggregate average wages paid per covered worker. The index was constructed by dividing market aggregate average wages per worker by the national mean wage per worker, where the national mean wage was an unweighted average across labor markets. This index adjusted hospital prospective payments in federal years (FY) 1984 and 1985.

While the BLS data represented the best national and regional data available at the time, technical limitations of this data were recognized from the start. These included the following:

- The series measures average wage per worker without distinguishing between full–time and part–time employees. Thus, the average hourly wage rate would be underestimated in geographic areas more likely to rely on part–time labor, and vice–versa.

- The data were tied to wages and workers covered by unemployment insurance. They were also subject to distortion by short–term fluctuations caused by natural disasters, strikes or retro–active adjustments.

- The data measured aggregate wages without adjustment for differences in skill mix. Therefore the index values reflected market–level variation in both the price level and the mix of occupations.

- The data did not include benefits or other wage–related costs that are also part of total compensation.

Congress attempted to address some of these problems in the Deficit Reduction Act of 1984 (P.L. 98–369). Section 2816 of this law required CMS (then HCFA) to develop a new data

collection tool for use in constructing a hospital wage index, specifically identifying the need to control for part–time employment and to explore ways to adjust for occupation mix differences.

1.2.2 CMS Wage Surveys

1982 Wage Data

CMS developed a survey for all Medicare participating hospitals that collected data on wages and paid hours of employment known as the HCFA Wage Index Survey. The first HCFA survey was conducted in 1984 and collected data from FY 1982, to be used for adjusting payments in FY 1986.

The major improvements of the new wage data were that they measured average wage per hour rather than per worker, thus controlling for part–time workers and eliminating distortions from non–recurring changes in total employment. The index was constructed in a similar manner to the construction from the BLS data, using aggregate average hourly wages for each labor market divided by a national average hourly wage that was an unweighted mean across all labor markets (50 FR 35661, September 3, 1985).

Implementation of the new index was delayed from October 1, 1985 to May 1, 1986 by the Consolidated Omnibus Budget Reconciliation Act of 1985 (P.L. 99–272, Section 9103). The index was in effect for the remainder of FY 1986 and all of FY 1987.

1984 Wage Data

As part of their audit activities in FY 1986, CMS instructed its intermediaries to collect the same wage survey data from providers' 1984 records (51 FR 31499, September 3, 1986) . This information was to be used for the index to adjust payments in FY 1988. A separate effort was undertaken to gather 1986 wage data by occupational category, but hospitals were given very little time to respond to the survey and many claimed they did not have reliable wage data by occupation. Only one–third of the hospitals responded to the survey, and collection of occupation–specific wage data was subsequently abandoned (Pope and Adamache, 1993).

To cushion large market–level changes, CMS used a blend of 1982 and 1984 wage data to construct the index applicable to payments in FY 1988 and FY 1989 (Federal Registers September 1, 1987 and May 8, 1989, p. 19646). Also at that time, the national average wage used to normalize the index was changed to the aggregate average (i.e. sum of all wages divided by the sum of all hours) rather than the unweighted average across markets.[1] An index was constructed from 1984 survey data alone was not used for payments in FY 1990 (Federal Register September 1, 1989, p. 36475).

[1] This change was made because the unweighted national average was sensitive to wage corrections and area re-designations, which tended to make the index unstable. Changing the normalization factor does not alter the market relative values but it does alter the actual level of the index; to maintain budget neutrality, the federal payment amount had to be re-standardized in FY 1988 (52 FR 22102).

1988 Wage Data

A new wage survey was fielded in 1990 that collected data from providers' 1988 records to serve as the basis for adjusting payments in FY 1991. The new survey incorporated several data changes including the addition of fringe benefits, home office costs and limited types of contract labor. It also added lines to identify and exclude wages and hours associated with nursing units and other non–hospital activities. Data on contract labor were later excluded from the computation due to problems in reporting paid contract hours. Because of the remaining changes and the long period elapsed between wage surveys (1984 to 1988), a one year transition was initiated for those labor markets where the index value would have changed by more than eight percent (Federal Register, September 4 1990 p 36041). However, when Congress delayed implementation of the 1988 survey until January 1991, CMS eliminated the one year phase–in (Federal Register, January 7, 1991, 562). The wage index from the 1988 survey continued to be used for IPPS payments throughout FY 1992 and 1993.

Medicare Cost Report (MCR) Wage Data

The time lag between data collection and application to payments was thought to present problems for hospitals in some regions, particularly those experiencing rapid wage increases for clinical personnel (Wellever 2000). Congress addressed the issue of data timeliness in PL 101–239 (OBRA 1989), by directing CMS to update the index annually beginning in FY 1994. CMS incorporated worksheets into the annual Medicare cost report (Worksheet S3 Parts II and III), as the source for annual updates on wages and paid hours (Federal Register, September 1, 1992 p.39746). The first MCR wage data were from the FY 1990 cost reports and were used to construct the index for FY 1994 payments. New wage index computations have been made annually since that year. Although incorporating the wage data into the cost report solved the problem of regularity in the updates, it did not improve the timeliness of the wage index, as the four–year lag between the data year and the index year has remained in effect. The lag is due to the length of the cost reporting cycle and the need to allow time for review and corrections.

1.2.3 Changes in the Computation of PPS Hourly Wage

The rules for computing the average hourly wage applicable to IPPS activities have been modified several times since the survey was first incorporated into the annual cost report. After having to exclude contract labor as reported in the 1988 survey due to incomplete or inaccurate data (Federal Register, September 1, 1992 p.39746), CMS revised and clarified the rules for reporting contracted labor for the worksheets in the FY 1990 cost report. An audit of the data was conducted and CMS found it to be "reasonable" and the costs for contract services directly related to patient care were included in the average hourly wage calculations beginning in FY 1994 (Federal Register, May 26, 1993 p 30222).[2] Benefits—primarily payroll taxes, health

[2] Including contract costs was a particular concern of rural providers during this time, because it was thought that rural hospitals made a disproportionate use of professional contract labor in response to skilled worker shortages (Size, 1992). Excluding higher-paid contract labor would therefore have the effect of artificially lowering average hourly wages in rural markets. Also in response to rural concerns, CMS began to include contract costs and hours of chief executive officers and other high-level administrators hired under certain management contracts, beginning in FY 1995 (Federal Register, May 27, 1994 p27708).

insurance and pension costs—were incorporated into the 1988 survey but multiple clarifications of what constitutes allowable wage related costs have been issued since that time.

The definition of allowable wages and hours has also been modified to allow the average hourly wage to reflect those amounts associated with activities included under IPPS –DRG payments only. The 1988 survey first excluded data for SNF and long–term care units. In subsequent years exclusions were expanded to other non–IPPS areas (home health agencies, inpatient rehabilitation and psychiatric units, federally–qualified clinics) and then incorporated lines to track wages and hours for general administrative and hospital support services in order to pro–rate these according to the ratio of IPPS and non–IPPS salaries. In 2000, the survey began adjusting for wages related to teaching physicians and medical residents, and after a five–year phase out, CMS removed these components to the hourly wage computation by 2004 (64 FR 41508).

1.3 Labor Markets

1.3.1 Definitions

"Area wage variation" is the variation of relative wages across hospital labor markets. CMS has always defined labor markets based on metropolitan county classifications of the Office of Management and Budget (OMB). From FY 1984 to FY 2004 these were primarily based on Metropolitan Statistical Areas (MSAs), with a few instances of MSAs further grouped into Primary Metropolitan Statistical Areas (PMSAs) or New England County Metropolitan Areas (NECMAs); non–metropolitan counties grouped into single state–level rural labor markets. In 2003, OMB used the 2000 census data to revise its metropolitan statistical area definitions and announced new Core–Based Statistical Areas (CBSAs). OMB defines a CBSA as a county or group of counties that form "a geographic entity associated with at least one core of 10,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties". CBSAs identify metropolitan areas (still referred to as MSAs) that are similar to the MSAs under the old classification system (at least one core of 50,000 or more population), but also identify a new category called "micropolitan areas" that include counties or small groups of counties with at least one core having 10,000–50,000 population. CMS adopted the new CBSA metropolitan areas as labor markets effective with the wage index applicable to FY 2005, but continued to group micropolitan counties with other rural counties to form state–wide rural markets [3] (69 FR 49026).

Because some counties previously included in MSAs became micropolitan, several hospitals that had been classified as urban became rural. CMS provided a "hold harmless' transition period for these facilities that allowed them to maintain their assignment to the MSA where they were previously located for three years, from FY 2005 – FY 2007. Beginning in 2008, these hospitals will receive their statewide rural wage index, although they will be eligible to apply for reclassification during or after the transition period (71 FR 48007). Hospitals located in all other areas that experienced a reduction in their wage index as a result of the change from

[3] In a few very large areas labor markets use a subdivided category called Metropolitan Divisions.

MSAs to CBSAs were allowed a two–year phase–in of the new index (i.e., a 50–50 blend in 2005, and the full new index in 2006). Hospitals in areas where CBSA changes caused an increase in the index were paid using that increased index.

1.3.2 Geographic Reclassification

MSAs are aggregates of counties based primarily on population size and commuting patterns. From the outset there were numerous critics of the use of aggregated geo–political units to define economic markets, particularly among providers in the state–level rural markets, where average wages tended to be low. In the late 1980s some argued in favor of a regional wage index to correct for perceived underpayments to rural hospitals located near or adjacent to urban areas, but CMS concluded that a regional wage index would not substantively improve these problems and would lead to excessive intra–market variation (Federal Register September 1, 1989, p. 36476). ProPAC had studied intra–market variation in wages and confirmed that variation was in part due to differences in skill mix, competition, and staffing practices among hospitals (ProPAC 1986). For labor market boundaries with large differences in index values, there was concern that the wage index could unfairly penalize hospitals that competed for workers within the same labor pool. In 1987 and 1988 Congress intervened through the Omnibus Budget Reconciliation Act of 1987 (P.L. 100–203, later amended by P.L. 100–360) by allowing the Secretary to treat some counties as urban for wage index purposes if they met certain criteria regarding commuting patterns to adjacent MSAs. These exceptions are referred to as "Lugar counties," and they created hospitals that were "deemed urban", effective October 1988 (FY 1989). However, the exceptions created instability in the average wage values for the adjacent MSAs and the original rural markets, and subsequent attempts to fix this (P.L. 100–647) inadvertently reduced the benefit of reclassification for some of the very counties that the exceptions were intending to help. The Omnibus Budget Reconciliation Act of 1989 (P.L. 101–239) addressed some of these problems by creating a mid–year change (effective for discharges after April 1, 1990) that limited the negative impact of redesignated hospitals or counties on existing MSA index values.

In P.L. 101–239 Congress also responded to industry requests for a better labor market assignments exceptions process by establishing the Medicare Geographic Classification Review Board (MGCRB). Interim Final Rules for geographic reclassification were published in September of 1990 (55 FR 36754) and finalized in June of 1991 (56 FR 25458). Beginning in FY 1991, hospitals meeting certain criteria could apply for reclassification from their geographically assigned labor market to a neighboring labor market to be effective during the following payment year, if the hospital met certain qualifications with respect to geographic proximity and contiguity, and wage comparability. In some situations entire counties are allowed to seek re–designation from one market to another. The rules also limited the impact that reclassifications could have on the individual index values for markets to or from which the reclassifications were being made (although the overall impact of reclassifications on PPS payments must be made budget neutral).

In its first year of operation, the MGCRB approved 90% of the requests it received, and as a result 930 primarily rural hospitals were reclassified in FY 1992, including twenty–eight percent of all rural PPS providers. This large number of reclassifications was not expected, and to meet statutory budget neutrality requirements the standardized payment amounts for urban areas had to be reduced by 1.1 percent. In September 1992 CMS restricted the criteria for

eligibility in the applications that were to become effective in FY 1994. Under the first year of these rules the number of reclassified hospitals declined by approximately 60 percent (Federal Register, May 27, 1994).

While the MGCRB reclassifications benefited some hospitals, ProPAC and some others in the provider community argued for an adoption of new labor market area definitions to address the fundamental flaws to any system based on geo–political boundary lines. In 1993, ProPAC recommended defining hospital–specific labor market areas based on geographic proximity by using a "nearest neighbor" principle. This method suggested computing local average wages using an average for all facilities located within a certain fixed radius of each PPS hospital (ProPAC 1993). CMS conducted its own analysis of the nearest neighbor proposal in 1994 and requested public comment on the approach in May of 1994 (59 FR 27724), but finding no strong support within the industry for the change, subsequently decided to not adopt it (60 FR 29219). At that time the agency stated its belief that a classification system that combined an MSA–based approach with hospital–specific exceptions had "considerable potential for improving the wage index".

Hospitals may qualify for reclassification to an adjacent labor market area if they meet certain criteria relating to geographic proximity and wage cost comparability. Since 2002, these have been the following:

- If the hospital is rural, proximity is defined as location within 35 miles of the border of the market to which reclassification is requested. If the hospital is urban, the definition is within 15 miles. Alternatively, proximity conditions can be met if 50 percent of the hospital's workers live in the market to which reclassification is being requested.

- Hospitals must demonstrate that their hourly wages are comparable to the average wages of the market to which they are requesting reclassification. If the requesting hospital is rural, comparability is defined as a hospital hourly wage no less than 82 percent of the hourly wages in the market to which they are requesting reclassification, and no less than 106 percent of the average wage of all other hospitals in their geographic market. If the requesting hospital is urban, the thresholds are 84 percent and 108 percent, respectively.

- If the hospital is or has ever been classified as a rural referral center (RRC), it is not required to meet the 106 percent criterion.

- If the hospital is a sole community hospital (SCH) or an RRC, it is not required to meet the proximity criteria.

- Further special exceptions are allowed for SCHs in low population density areas to reclassify to any MSA in their state.

Reclassification requests were originally granted for one year only, but began to be effective for three year periods in FY 2003. Wage comparability tests since FY 2003 have been based on rolling 3–year average wages published by CMS.

Under certain circumstances county–level or even state–level reclassifications can be granted, provided all hospitals in the group agree. Reclassifications are permitted from one rural market to another, from one urban market to another, and from a rural market to an urban market. Reclassifications from urban markets to rural markets were not originally permitted, but were added under Section 401 of the BBRA of 1999, directing the Secretary to treat qualifying urban hospitals as though they are located in the rural area of their States (FR 65 47087). Section 401 hospitals therefore qualify for other PPS payment exceptions applicable to rural facilities, including sole community or rural referral center status and special exceptions and hold–harmless provisions under the hospital outpatient PPS.

In late 2003, Section 508 of the MMA (P.L.108–173) added a provision that allowed the Secretary to exercise discretion in granting one–time special appeals on selected reclassification requests that did not otherwise meet MGCRB criteria. Section 508 reclassifications were originally applicable to discharges occurring between April 1, 2004 and March 31, 2007, but were extended to the close of FY 2007 by the Tax Relief and Health Care Act of 2006.

Reclassifying hospitals from one market to another alters the average wages of both the sending and the receiving markets.[4] MGCRB implementing regulations limit the impact of this on the final wage index. For markets that hospitals are reclassifying *out of*

- Index values for rural markets are held harmless; index values are computed using the higher of average wages based on all facilities geographically located in that market, or all facilities assigned to that market post–reclassification.

- Index values for urban markets are computed without the data from reclassified facilities. However, if all facilities in an urban market are reclassified out of that market, the published value for that market is equal to the pre–reclassified index value. Index values for urban markets could not be reduced to a value that was lower than the index for the state rural market.

For markets that hospitals are reclassifying *in to*

- If the index value for the markets declines by less than one percent as a result of adding data from the newly reclassified hospitals, then the index is computed excluding data from the reclassifying hospitals and the index applies to geographically located as well as newly reclassified hospitals.

- If the index value for the markets declines by one percent or more as a result of adding data from the newly reclassified hospitals, then an index value from the new combined average wage is computed, but it is applicable only to the reclassifying facilities. For hospitals geographically located in that market, the index is based on average wages computed from data for facilities geographically located in, and not seeking reclassification out of, that market.

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[4] Reclassifying hospitals tend to be at the upper end of the distribution of average wages in the market they are leaving, but at the lower end of the distribution in the market into which they are requesting reclassification. Thus in many circumstances, reclassification leads to a reduction in average wages for both markets.

1.4 Occupation Mix Adjustment

Following the failure of the 1986 special survey on occupation mix, CMS expressed a willingness to revisit the issue at some point in the future to take occupational mix into account in calculating the wage index (Federal Register, September 1, 1987, p.33041). Although CMS announced its intention to collect occupational–mix adjustment data two years later in the PPS Final Rules published in September of 1989, by 1991 occupational–mix adjustments had been reviewed again and ruled out "at that time" (Federal Register, June 3, 1991, p. 25192). The reasons cited included (1) the administrative burden on hospitals was heavy, (2) the definition of the optimal mix of occupations was not known (3) the desirability (or equity impact) of redistributing PPS payments was not clear, and (4) that the impact of standardizing relative wages for occupation mix differences across markets may have been overstated (Wellever 2000).

The issue of occupational mix adjustment was then reintroduced by Congress when the Benefits Improvement and Protection Act of 2000 (BIPA) was passed (PL 106–554). The legislation mandated that the hospital wage index be adjusted to reflect the occupational mix of employees, and ordered CMS to collect data on the occupational mix of employees for each hospital no less frequently than every three years.

CMS' initial occupational mix survey following this legislation occurred in early 2003, collecting data also from a period spanning 2001 to 2003. Paid hours were collected on 19 occupation groups representing just over one–half of hospital employment. These were used to construct a set of adjustment factors for covered occupations that would standardize the wage index applicable to payments in FY 2005 through FY 2007 (non–covered occupations were effectively given an occupation weight of one). Due to a number of concerns about data quality, CMS decided to implement a blended index using only 10% occupation mix–adjusted and 90% unadjusted values (Federal Register, August 11, 2004). In addition, CMS stated they wanted to move cautiously with occupational mix adjustment in recognition of changing trends in the hiring of nurses, the largest group in the occupational mix survey. The second "triennial" occupation mix survey occurred in 2006, and in this survey CMS expanded data collection for additional categories of nursing employment but dropped the data collection for non–nursing occupation groups.

The nursing occupation mix survey was fielded from January to June of 2006, with the intention of being used to develop nursing–only occupation mix adjustment factors for the wage index applied to payments from FY 2008 through FY 2010. In April 2006, in Bellevue Hosp. Center v. Leavitt, the Court of Appeals for the Second Circuit ordered CMS to apply the occupational mix adjustment to 100 percent of the wage index effective for FY 2007. Rather than use a 100% adjustment from the 2003 survey, CMS chose to use the first 3 months of data collected from the 2006 survey to calculate a new "nursing only" occupational mix adjustment (71 FR 47870, August 18, 2006). This final index affected payments for discharges starting October 1 (71 FR 59886, October 11, 2006). The full 6 months of data will be used to construct occupation mix adjustment factors for the FY 2008 wage index.

1.5 Other Adjustments

Two other major adjustments to the hospital wage index are allowed under IPPS. One is referred to as the "rural floor," and the other is the "out–migration adjustment."

1.5.1 Rural Floors

Section 4410 of the BBA (P.L. 105–33) provided that for discharges occurring on or after October 1, 1997, the area wage index applicable to any hospital that is located in an urban area of a state may not be less than the area wage index applicable to hospitals located in rural areas in the state (69 FR 49109). Commonly referred to as the "rural floor", this provision is actually an urban floor, in that it sets a minimum index value for any urban labor index that is equal to the rural index value for the state where that MSA is located. "Rural floors" are distinguished from "urban to rural" reclassifications in that they do not re–group hospitals into different labor markets for purposes of re–computing average market wages. Rural floors do not change anything about the computation of the wage index, but do alter the assignment of specific wage index values. Hospitals benefiting from the rural floor provisions receive the higher rural wage index value, but do not alter their status as urban hospitals.

The rural floor provision could not be applied in the two States where there were no non–metropolitan areas (New Jersey and Rhode Island). Hospitals in those two States commented that the absence of a rural floor disadvantaged them for wage index purposes compared to hospitals where the rural floor provision applied (69 FR 28291), contending that they would have higher wage indexes if there were a rural area in their State to set a floor under the wage indexes within that State. CMS agreed with these hospitals and subsequently developed an "imputed floor" for the two all–urban States (based on the ratio of the lowest to highest index values in states that did have applicable rural floors). CMS went further with this to also impute a floor for Massachusetts, which had geographic rural areas but no IPPS hospitals actually classified as rural. Despite some objections in the public comments, CMS adopted a policy of imputing hypothetical rural floors for these three states, but limited the effective period to 3 years (FYs 2005, 2006, and 2007) so that CMS could monitor the policy change (69 FR 49110).

1.5.2 Out–Migration Adjustments

Section 505 of the MMA provided for an increase in the wage index for certain hospitals located in counties that have a high percentage of residents that commute for hospital employment in neighboring higher–wage MSAs. The Secretary set a commuting (or "out–migration") threshold of ten percent for counties to qualify for the adjustment, based on commuting patterns as identified from decennial census data. In addition, hospitals located in qualifying counties must have average wages that are higher than the average for the labor market in which they are located. By statute hospitals that are "deemed urban", hospitals that are reclassified through the MGCRB, and hospitals that are reclassified under the terms of Section 508 of the MMA cannot receive this adjustment.

Qualifying counties are identified for three–year periods (commuting patterns are measured only every ten years, but because qualification is a function of commuting percentages and relative wages, a change in the index could trigger a change in eligibility). Qualifying hospitals located in qualifying counties receive an increase in the wage index that is equal to an average of the difference between the wage index for the resident county and the higher wage index for the work area county(s), weighted by the overall percentage of workers who are employed in an area with a higher wage index. When this adjustment was first implemented in FY 2005, 230 counties met the commuting criteria for the adjustment (69 FR 49064, August 11, 2004). There were 415 PPS hospitals located within these counties and of these, 181 were not

eligible because they were already reclassified. Of the remaining 234 hospitals, automatic positive adjustments to the wage index were processed for those with hourly wages greater than the pre–reclassified market average.

The out–migration adjustment is unusual in that is not required to be budget neutral. At the individual hospital level the adjustments can be substantial, with some counties qualifying for increases of more than ten percent. However, due to the relatively small size of the qualifying counties and the small number of hospitals that qualify, CMS estimated that the impact on total hospital payments would be minimal, with an overall impact of 0.1 percent.

1.6 Wage Index Implementation as of FY 2007

Most of the adjustments, exceptions and market reclassification opportunities have been added cumulatively to the wage index, such that a substantial portion of PPS facilities operate under one or another of them. ***Table 2*** identifies rural and urban providers that are paid under IPPS in FY 2007 and are therefore subject to the wage index. Nearly four of every ten PPS hospitals has some sort of exception. Thirty–nine percent of all rural facilities and 17 percent of all urban facilities have some sort of reclassification. Ten percent of urban providers are located in MSAs subject to the rural floor provisions or to the imputed rural floors. Outmigration adjustments increase the index values for two percent of urban PPS providers (133 hospitals) but nine percent of rural ones (90 hospitals). The size of the adjustments averages 1.3 percent across qualifying urban counties but 3.4 percent across qualifying rural ones.

1.7 Summary Comparison: BLS Versus CMS Source Data

MedPAC's proposed alternative approach to computing a wage index is recommending that CMS return to the BLS as the source for area wage data. However, both the BLS data that MedPAC is recommending and its proposed new approach to computing the index are very different from the original BLS index used by CMS for the first two years of inpatient PPS. Where the original BLS series (as well as the subsequent CMS wage data) were hospital–specific averages of wages for all occupations, the Occupation Employment Statistics (OES) data now proposed are all–industry measures of average wages by occupation. Further, where the original data measured average wages per worker without adjustment for part–time status or occupation mix, the proposed BLS data come from surveys of average wages per hour, with adjustment for occupation mix based on national employment weights for short–term general hospitals. ***Table 4*** presents the main differences between BLS data as originally used in the first PPS wage indexes, the CMS data as developed over the last twenty years under PPS, and the BLS OES data as now proposed for an alternative approach to area wage adjustment.

Table 2
Summary of Exceptions and Adjustments to the Hospital Area Wage Index as Implemented for FY 2007 IPPS

	Provider Counts and Percents					
	Urban		Rural		Total	
Total inpatient PPS providers (FY 2007 Impact File)	2,590	*100%*	1,005	*100%*	3,595	*100%*
Labor market reclassifications:						
Lugar Counties ("deemed urban", since 1988)	49	*2%*			49	*1%*
MGCRB decisions, standard criteria	280	*11%*	358	*36%*	638	*18%*
MGCRB decisions (MMA "Section 508" special appeals)	81	*3%*	27	*3%*	108	*3%*
Urban to Rural (BIPA "Section 401" providers)	30	*1%*	*		30	*1%*
"Special Exceptions" by the Secretary (*see note*)	13	*1%*	5	*0.5%*	18	*1%*
Subtotal, all reclassified providers	453	*17%*	390	*39%*	843	*23%*
Out–migration adjustments (MMA "Section 505")	133	*2%*	91	*9%*	224	*6%*
Mean value of adjustments:	*1.3%*		*3.2%*		*2.1%*	
Minimum	*0.07%*		*0.07%*		*0.07%*	
Maximum	*5.6%*		*12.4%*		*12.4%*	
Rural floor index assigned						
Original: providers in states with rural markets	216	*8%*	**		216	*6%*
Imputed: providers in "all urban states	40	*2%*			40	*1%*
"Hold–Harmless" providers from MSA–to–CBSA change (now in rural but formerly in metropolitan markets, allowed to retain former metropolitan designation for three years, FY 2005–2007)			46	*5%*	46	*1%*
Summary Count: at least one exception to assigned labor market or computed wage index:	842	*33%*	481	*47%*	1323	*37%*

* Five providers in this category were identified in the CMS impact file as rural (presumed error; placed in urban column)

** Two providers in this category were identified in the CMS impact file as rural (presumed error; placed in urban column)

NOTE: "Special exceptions" are reclassifications allowed at the discretion of the Secretary for certain providers that had previously qualified under rules for group (county–wide) reclassifications, where statutory changes related to other PPS provisions would otherwise have disqualified these providers from reclassification. These exceptions were first implemented in FY 2005 (see 69 FR 49104–49105).

SOURCES: RTI analysis of FY 2007 Impact File as published October 2006, supplemented by Tables 4A–1, 4B–1, 4C–1, 4F, 4J, 9A, 9B and 9C published in FR 71– 59975 to 60040. Rural floor providers were identified by table forwarded from CMS.

Table 3
Hospital Area Wage Index Chronology, by Year of Implementation

Payment Fiscal Year	Wage Data Source	Data Definitions and Adjustments	Labor Market Definitions	Labor Market Exceptions	Other Adjustments and Exceptions
1984	BLS	Market aggregate average hospital wage/worker; national = unweighted average across areas	MSAs or state non–metro	None	None
1985	BLS	Same	Same	None	None
1986	1982 HCFA Wage Index Survey (HWIS)	Market aggregate average hospital hourly wage; national = unweighted average across areas	Same	None	None
1987	50/50 blend of 1982 and 1984 HWIS[1]	Market aggregate average hospital hourly wage; national = aggregate average hourly wage	Same	None	None
1988	Blend of 1982 and 1984 HWIS	Same	Same		
1989	Same	Same	Same	"Lugar" Counties (hospitals deemed urban based on commuting patterns to adjacent MSA)	Index re–computed for affected MSAs and rural areas as though deemed hospitals were located in adjacent MSA
1990	1984 HWIS	Same	Same	"Lugar" Counties	Index assignments for "deemed urban" counties set at higher of county–specific or rural rate; rural areas held harmless from any reduction
1991	1988 HWIS	Excluded data from non–acute hospital areas; included fringe benefits and better editing. 100% 1988 data implemented as of 1/1/91 (proposed phase–in of 1988 survey data for areas with large shifts was dropped following mandated delay of implementation date).	Same	"Lugar" Counties	Limited negative impact of reclassification (on facilities originally located in urban markets) to 1 percent reduction.
1992	1988 HWIS	Same	Same	"Lugar" Counties First year of MGCRB reclassifications implemented for rural–to–rural, rural–to–urban and urban–to–urban changes (930 hospitals)	Same

(continued)

Table 3 (continued)
Hospital Area Wage Index Chronology, by Year of Implementation

Payment Fiscal Year	Wage Data Source	Data Definitions and Adjustments	Labor Market Definitions	Labor Market Exceptions	Other Adjustments and Exceptions
1993	1988 HWIS	Same	Reclassification criteria tightened	Lugar Counties 2nd year of MGCRB reclassifications	Same
1994	1990 Medicare Cost Reports (MCR)	Allowed wages and hours for professional contract services if directly related to patient care.	Same	Lugar Counties 3rd year of MGCRB reclassifications; number approved reduced by 60 percent under revised eligibility criteria	Same
1995	1991 MCR	Allowed wages and hours for contracted managers	Same	Same	Same
1996	1992 MCR	Same	Same	Same	Same
1997	1993 MCR	Same	Same	Same	Same
1998	1994 MCR	Same	Same	Same	BBA adds "Rural floors" where urban WI values cannot be lower than state rural values
1999	1995 MCR	Allowed wages and hours for contract physician Part A costs	Same	BBRA Section 401 allows urban–to–rural reclassifications	Same
2000	1996 MCR	Began a five–year phase–out of wages and hours for teaching physicians, medical residents and nurse anesthetists	Same	441 total hospitals were re–declassified hospitals	Same
2001	1997 MCR	Same	Same	Same	Same
2002	1998 MCR	Same	Same	Same	Same
2003	1999 MCR	2003 Occupational Mix data collected	Same	MGCRB decisions become effective for three years	Same
2004	2000 MCR		Same	MMA adds "Section 508" reclassification decision appeals permitted	MMA adds "Section 505" out–migration adjustments to wage index for qualifying counties MMA places upper limit of 62% on labor–related share of standardized rate topped at 62% for markets with WI below 1.00.

(continued)

Table 3 (continued)
Hospital Area Wage Index Chronology, by Year of Implementation

Payment Fiscal Year	Wage Data Source	Data Definitions and Adjustments	Labor Market Definitions	Labor Market Exceptions	Other Adjustments and Exceptions
2005	2001 MCR, adjusted by 10% 2003 Occupation Mix data	Occupation Mix Adjustment (OMA) implemented using 10% of computed adjustment factors	CBSA–based definitions of metropolitan areas; counties newly classified as non–metropolitan retain prior metropolitan assignment for 3 years ("hold harmless").		2–year phase–in for any markets with reduced wage index due to CBSA – related reassignment. "Imputed rural floors" added for all–urban states Occupation Mix Adjustment (OMA) implemented using 10% of computed adjustment factors
2006	2002 MCR, adjusted by 10% 2003 Occupation Mix data	Continued 10% OMA implementation	Same		
2007	2003 MCR, adjusted by 100% 2006 Occupation Mix data	Court order overrules 10% phase–in; CMS implements 100% OMA from 2006 one year ahead of schedule	Same	CMS re–assigns hospital wage index exceptions and reclassifications based on highest payments after occupation–mix revision	

SOURCE: RTI analysis of Federal Registers and other sources.

Table 4
Summary Differences between BLS and CMS Source Data

Original BLS wage data (used for payments in FY 1984 and 1985)	CMS wage data (used for payments in FY 1986 and later)	Proposed new BLS wage data
Data: Employment Series 202 for SIC 206 (hospitals). (Calendar 1981 data series)	Data: **HCFA Wage index Surveys (periodic, earliest 1982 latest 1988), used for payments from FY 1986 through FY 1993** **Medicare cost report Worksheet S–3 (starting FY 1990 data), used for payments from FY 1994 on.**	**Data:** Occupation Employment Statistics (OES); all–industry average hourly wages by state and/or metropolitan area, for key hospital occupations as reported in Industry–Specific Occupational Employment & Wage Estimates for NAICS 622100 (General Medical and Surgical Hospitals)
Source: Quarterly tax filings with State Employment Security Agencies, from all non–federal hospitals	Source: **HCFA (CMS) surveys from all PPS hospitals (to payment year 1993)** **Annual cost report wage data (Wks S–3) beginning FY 1994**	**Source:** BLS employer surveys conducted over rolling 3–year periods (data contributed by approximately 70% of all employers).
Measures: County aggregates of total covered wages County aggregates of total covered workers	Measures: **PPS Hospital average hourly wage (until 1988 survey)** **PPS Hospital average hourly total compensation (after 1988)**	**Measures:** Average hourly wages by occupation, computed across all industry settings for that occupation
Index construction: MSA or rural market–level aggregate average wage per worker / National area–weighted average wage per worker (= unweighted mean of market average wages, computed across all labor markets)	Index construction: **MSA or rural market–level aggregate average hourly wage** **/** **National aggregate average hourly (note: use of aggregate average in denominator was adopted in 1988)**	**Index construction:** MSA or rural market–level weighted sum of occupation–specific relative wages, where: occupation–specific relative wage = occupation hourly wage / national hourly wage and weights for weighted sum= occupation–specific hospital wages / total hospital wages
Comments: o No adjustment for part–time workers o Influenced by seasonal variation, work stoppages and bonus or back pay o No data on benefits or contract labor o Data suppressed for counties with <3 reporting entities o 3–year lag from data year to payment year o No opportunity for occupation mix adjustment o Average wages reflect all hospital pay, including non–PPS	Comments o **Adjusts for part–time workers** o **Not influenced by variations in total employment** o **Surveys gradually added data on benefits and contract labor between 1986 and 1990. Cost report worksheets gradually added adjustments to limit reporting to IPPS portions of hospital operations.** o **Data suppressed only for hospitals reporting below minimum wage or > 2.5 times national hourly** o **4–year lag from data year to payment year** o **No occupation mix adjustment from S–3; additional survey data mandated for collection 2003 and again in 2006, selected occupations only** o **Hourly wages reflect PPS hospital pay only**	**Comments:** o Hourly wage corrects for part–time workers o Not influenced by variations in total employment o No data on benefits o Contract labor wages are reported by contractor o Data suppressed for MSA/occupation combinations with large sampling error o 3– to 5–year lag from data year to payment year (i.e. ⅓ 3–yr + ⅓ 4–yr +⅓ 5–yr) o Fixed national occupation weights for all occupations in the index computation, updated annually o Hourly wages reflect all–industry averages, to extent that specific occupations are found in hospital and non–hospital settings

SOURCE: RTI analysis of BLS and CMS wage data documentation.

2.0 SELECTED ISSUES IN ALTERNATIVE APPROACHES TO HOSPITAL WAGE INDEXES

This chapter discusses selected issues in two alternative approaches to constructing the Medicare inpatient prospective payment system (IPPS) hospital wage index. The alternative approaches are Medicare's current index based on its survey of hospital–specific wages and compensation and MedPAC's alternative approach based on BLS all–industry wage data. We begin the chapter in Section 2.1 with a presentation of the theory of wage indexes, and how Medicare's and MedPAC's approaches are related to theoretical wage indexes. Because use of hospital–specific versus all–industry wage data is a key difference in the two approaches, we discuss the theory and empirical evidence on inter–industry wage differentials, and implications for the hospital wage index in Section 2.2. Section 2.2 also contains empirical analysis using BLS data of national differences in wages by industry. Section 2.3 evaluates the industry composition of the MedPAC BLS wage index. We show that the MedPAC BLS wage index can be interpreted as a blend of a hospital–specific wage index (one–third weight) and a non–hospital wage index (two–thirds weight). Section 2.4 summarizes earlier research RTI staff did for CMS on the factors that impact average hospital wages, which are the current basis of the IPPS wage index. Section 2.5 presents arguments for and against the use of hospital–specific versus all–industry wage data in the IPPS hospital wage index in the context of the previous sections.

2.1 Theory of Wage Indexes

2.1.1 Hospital Cost Functions and Wage Indexes

The IPPS is intended to reimburse hospitals for the cost of providing efficient inpatient treatments to patients. A large component of the cost is wages paid to employees, which vary across geographic areas. The hospital wage index is intended to adjust for geographic variation in wages.

Economists represent hospital costs by a "cost function" (Varian, 1978), which relates total costs C(j) in area j to the "output" Q of the hospital and the vector of input prices (wages) w(i, j) it faces in area j for occupations indexed by i:

$$C(j) = C(Q, w(i, j)). \quad (1)$$

The wage index is a measure of costs in one area relative to another. Typically, the base or denominator of the wage index is the nation as a whole, which we denote by N. The ratio of costs in area j to the nation N are

$$C(j)/C(N) = C(Q, w(i, j))/C(Q, w(i, N)). \quad (2)$$

Equation (2) keeps output Q the same in area j as in the nation because the IPPS adjusts payments for hospital outputs through its diagnosis–related–group (DRG) casemix index, not the wage index. The wage index is a measure of the effect of wage, not output, variation on costs. Equation (2) also assumes that the hospital cost function C(Q, w(i, j)) is the same in area j as in the nation, that is, that the *technology* of hospital patient treatment is the same.

In general, as shown by equation (2), the relative wage index depends on output Q (even if it is the same in both areas) and wages in the two areas w(i, j) and w(i, N). However, if the cost function C is "multiplicatively separable" in output and wages, the wage index depends only on wages:

$$C(j)/C(N) = f(Q)c(w(i, j))/f(Q)c(w(i, N)) = c(w(i, j))/c(w(i, N)). \quad (3)$$

Multiplicative separability is a property of certain theoretical cost functions often used by economists to model real–world cost relationships, such as the Cobb–Douglas cost function. The form of the cost function depends on the characteristics of the technology used in hospital production.

If the technology of hospital production exhibits no substitution among alternative types of labor (e.g., registered nurses and licensed practical nurses), then the wage index can be expressed as a fixed weight "Laspeyres" index. This index can be written as[5]

$$C(j)/C(N) = \sum es(i, N)*w(i, j)/ \Sigma es(i, N)*w(i, N), \quad (4)$$

where
es(i, N) = national employment shares of occupation i in hospital employment,
w(i, j) = the wage of occupation i in area j, and
w(i, N) = the wage of occupation i nationally.

Note that the Laspeyres wage index can also be written

$$C(j)/C(N) = \sum [es(i, N)*w(i, N)/\Sigma (es(i, N)*w(i, N))] * [w(i,j)/w(i, N)]$$

$$= \sum ws(i, N)* [w(i, j)/w(i, N)], \quad (5)$$

where
ws(i, N) is the national wage bill share of occupation i, the share of occupation i in total wages paid to all employees.

Equation (5) says that the wage index for an area is the sum of the products of the national wage bill share of each occupation and each occupation's wage in the area relative to its national average wage.

The Laspeyres form was chosen by MedPAC for its alternative wage index based on BLS data. If there is substitution among occupations, the correct functional form for the wage index will not be the fixed–weight Laspeyres. Other, more exotic functional forms (e.g., geometric, translog) correspond to different amounts of substitution. Although it seems unlikely that there is little or no substitution among hospital occupations, Pope (1989) shows that alternative functional forms has only a small empirical impact on wage index values, so that the choice of

[5] All summations in equations (4) and (5) are across occupations i.

functional form—among the range of reasonable possibilities—is not an important one. This result is driven by the fact that relative wages for important hospital occupational categories—especially nurses of different skill levels—do not vary substantially across areas.[6] Even if there are technical possibilities for substitution, if relative wages are nearly constant across areas, the cost–minimizing labor mix will be nearly the same in all areas, and a Laspeyres fixed weight index will accurately measure relative labor costs. The fixed weight Laspeyres form is simple, and widely used, accepted, and understood, so there would seem to be little reason to deviate from it. MedPAC's choice of the Laspeyres index form is reasonable.

2.1.2 Medicare IPPS Wage Index

Non–Occupationally–Adjusted Wage Index

The Medicare IPPS wage index is derived from average hourly hospital wages.[7] In its basic (non–occupationally–adjusted) form, the Medicare index is an area's average hourly hospital wage divided by the national average hourly hospital wage. This can be expressed as:

$$\text{IPPS wage index for area } j = \sum es(i, j)*w(i, j)/ \Sigma es(i, N)*w(i, N), \quad (6)$$

where es(i,j) = employment shares of labor category i in area j in hospital employment, and Σ es(i, N)*w(i, N) = the national average wage (NAW). The denominator of the IPPS wage index is the same as the denominator of the Laspeyres index shown in equation (4): both are the national average wage. But the numerator of the IPPS index uses area–specific labor category employment shares es(i, j) rather than the fixed, national shares es(i, N) used in the Laspeyres index. Thus, unlike the Laspeyres index, the IPPS index is influenced by area variations in hospital casemix, intensity and quality of care, business decisions on labor mix, and resulting occupation– and skill–mix differences (Pope, 1989). These variations should either be paid for through other elements of IPPS hospital payment (DRG casemix index, teaching adjustment), or payment should be neutral with respect to them (decisions on intensity and business decisions on labor mix).

Occupationally–Adjusted Wage Index

CMS has recently added an occupation–mix adjustment for nursing personnel to the Medicare IPPS wage index. In the adjusted index, each area's average hospital wage is replaced with an adjusted average hourly wage, defined as

$$\text{Adjusted average hourly wage} = [(\text{total nursing wages})*(\text{nursing occupational mix adjustment factor}) + (\text{total non–nursing wages})]/(\text{total hours}). \quad (7)$$

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6 In the BLS data analyzed for this report, the three correlations across areas of registered nurses, licensed practical nurse, and health support worker wages range from 0.68 to 0.80, a fairly high degree of correlation.

7 Actually compensation, but for simplicity we will use "wages" here.

If we decompose total wages into the product of the average hourly wage and hours worked for both nurses and other (non–nursing) occupations, and divide by total hours to get an employment share, we can express Medicare's occupationally–adjusted IPPS index as

Occupationally–adjusted IPPS wage index for area j =

$$[es(n,j)*w(n,j)*occ(n,j) + es(o,j)*w(o,j)]/NAW, \quad (8)$$

where
es(n,j) = the employment share of nurses in area j;
w(n,j) = the average hourly nurse wage in area j;
occ(n,j) = the CMS nursing occupation mix adjustment for area j;
es(o,j) = the employment share of other (non–nursing) occupations in area j;
w(o,j) = the average hourly wage of other occupations in area j; and
NAW = the national average wage.

Comparing equations (8) and (6), the major difference is the nursing occupation mix adjustment occ(n,j). This adjustment is computed as the ratio of the national average nursing wage to the area average nursing wage, where the "area average" is computed using area average nursing employment proportions, but national average wages by nursing category. So the occupation mix adjustment reflects the costliness of an area's nursing labor mix relative to the national average mix. If an area's nursing mix is more costly than average, its occupation mix adjustment is less than one, and its IPPS wage index value is reduced.

Although CMS' procedure adjusts for occupation mix within the nursing category, variations in labor mix between nursing and non–nursing occupations, and within non–nursing occupations, are not adjusted for. Nurse hours make up 43 percent of total hours in the Medicare hospital wage survey data according to CMS' proposed rule; while this is the largest component, it is still a minority of total hours. Thus, CMS' occupation mix adjustment applies to less than half the hospital work force.

Consider only the nursing portion of CMS' occupationally–adjusted wage index in (8). Does it appropriately adjust for nursing occupation mix? The formula (8) is different than the theoretically appropriate Laspeyres index formula (4). Are they equivalent? Pope (1989) shows that if relative occupational wages are constant across the country, the average hourly hospital wage on which the Medicare IPPS index is based can be decomposed as follows:

$$\text{Average hourly hospital wage in area j} = COL(j)*OCCMIX(j), \quad (9)$$

where COL(j) is a "cost of living" factor for area j that adjusts all wages in the area relative to the national average; and

$OCCMIX(j) = \Sigma\, w(i, N)*es(i,j)$ is an hospital occupation mix factor for area j that measures the costliness of an area's occupation mix using national average wages w(i, N) and area j employment proportions es(i,j).

Pope (1989) also presents evidence that relative hospital wages do not vary much across areas, so this decomposition is empirically reasonable. Furthermore, Pope (1989) notes that with this assumption, the theoretically appropriate hospital wage index is just COL(j).

The nursing portion of the occupationally–adjusted IPPS wage index can be written

$$\text{occupationally–adjusted IPPS wage index} = AHW(n,j)*occ(n,j)/AHW(n, N), \quad (10)$$

where AHW(n,j) = the average hourly wage for nursing occupations in area j;
occ(n,j) = the CMS nursing occupational mix adjustment as described above; and
AHW(n, N) = the national average hourly hospital nursing wage = Σ w(i, N)*es(i, N).

Under the assumption in equation (9), equation (10), the occupationally–adjusted IPPS wage index, can be written:

$$AHW(n,j)*occ(n,j)/AHW(n, N) = COL(j)*OCCMIX(j)*occ(j)/AHW(n, N). \quad (11)$$

But

$$occ(j) = \Sigma\, w(i, N)*es(i, N)/\Sigma w(i, N)*es(i,j), \quad (12)$$

so

$$occ(j)*OCCMIX(j) = [\Sigma\, w(i, N)*es(i, N)/\Sigma w(i, N)*es(i,j)]* \Sigma\, w(i, N)*es(i,j)$$

$$= \Sigma\, w(i, N)*es(i, N). \quad (13)$$

Hence, the Medicare occupationally–adjusted wage index (11) can be written

$$COL(j)* \Sigma\, w(i, N)*es(i, N)/AHW(n, N) = COL(j). \quad (14)$$

This algebra has proven that under the assumption of constant relative wages, the CMS formula for occupationally–adjusting the nursing wage yields the theoretically appropriate nursing wage index. Put simply, CMS' formula for occupationally–adjusting nursing wages is appropriate, at least under the assumption of constant relative nursing wages across areas.

Under this assumption (of constant relative wages), the Laspeyres form chosen by MedPAC is also appropriate and is in fact simpler, because it directly adjusts for occupation mix and does not require a separate occupation mix adjustment. Also, MedPAC's proposed index adjusts for occupation mix among all hospital personnel, not just nurses.

2.2 Hospital–Specific Versus All–Industry Wages

Medicare Payment Advisory Commission (MedPAC) staff have explored an alternative method of computing the IPPS wage index that relies on U.S. Bureau of Labor Statistics (BLS) Occupational Employment Statistic (OES) data, rather than the CMS Hospital Wage Survey data (MedPAC, 2007). Probably the most important distinction between the BLS and the CMS data is the that the BLS data measure average wages for workers in multiple occupations across all industries, whereas the CMS data measure average wages for all occupations in a single industry,

hospitals. Recently, CMS has also begun collecting hospital occupation–specific wage data for selected occupations.

Which of these two types of data—hospital–specific or all–industry—is a better measure of the wage rate input prices faced by hospitals? By "wage rate input prices", we mean the minimum wages that must be paid by a hospital to hire workers of specified characteristics (skills and productivity). Worker characteristics that could affect productivity include training, education, experience, ability, and motivation.

To address this question, we discuss the theory and evidence on first, in Section 2.2.1, the standard competitive wage setting model, and then, in Section 2.2.2, on *inter–industry wage differentials*. In Section 2.2.3, we discuss implications for the hospital wage index. In Section 2.2.4, we review some of the academic empirical literature on inter–industry wage differences, and in Section 2.2.5, we present evidence on inter–industry wage differences for hospital occupations from BLS data.

2.2.1 Theory of Competitive Wage Setting

The standard economic theory of market wage setting (see e.g., Ehrenberg and Smith, 1988) assumes perfect competition in both the labor and product markets. There are no deviations from perfect competition in either the supply of labor (such as might be caused by labor unions) or in the demand for labor (such as might be caused by only a single employer in an area with monopsony power). Further, the neoclassical competitive theory assumes that all workers within an occupation are identical and are perfect substitutes for each other, and that employers maximize profits, and hence hire workers at the lowest wage possible.[8] The theory also assumes that workers can move costlessly among firms, and that employers can hire replacement workers without loss of productivity.

Under these conditions, a single market wage rate for an occupation is determined by the intersection of the market aggregate supply of labor and demand for labor curves. This single equilibrium wage rate "clears the market" in the sense that aggregate supply of labor and aggregate demand for labor are equal at this, and only this, wage rate. At higher wage rates, the number of hours workers wish to work ("supply of labor") exceeds the hours of labor demanded by employers. The excess supply allows firms to hire workers at lower wages, putting downwards pressure on wages until they reach the equilibrium level. Analogously, at wages lower than the equilibrium wage, firms' demand for labor is greater than labor hours supplied by workers, so wages are bid up by employers until they reach the equilibrium level.

A corollary of competitive wage setting is that the wage rate paid by different industries for the same type of workers (same occupation) is identical. Industries and firms compete for workers. If one industry pays less than another, the workers will move to the higher–paying industry. Each industry is forced to pay the market wage to retain its work force and be able to hire new workers in the labor market.

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[8] Cost minimization is a necessary condition for profit maximization. To minimize costs, an employer must hire workers at the lowest wage possible.

On the other hand, firms never pay more than the market wage. This would lower their profits, and they are assumed to be profit maximizing (this assumption is relaxed later). Moreover, paying above–market wages would raise their costs, and hence the price of their final product. Since product markets are also assumed to be perfectly competitive, firms paying above market wages would not be able to sell their products (because their price is higher than the market price), and would go out of business.

Different industries might still pay the same wage rate to similar workers, even if some of the assumptions of the competitive wage setting model are violated. If for example, a dominant employer in an area (e.g., a large manufacturing firm) pays an above market wage, other industries (e.g., hospitals), in competition with the dominant industry, might have to pay the same wage to attract workers to their own industries. The outcome in this case would depend on how many workers the dominant industry was willing to hire at an above–market wage. If this industry was willing to employ a large fraction of the workers in the area at the higher wage, the other industries in the area would have to match the higher wage to retain their workers. The dominant industry essentially "pegs" the market wage rate to the level it pays. On the other hand, if the higher wage paid by the dominant industry (the large manufacturing firm) reduced its demand for labor relative to its demand at the competitive market wage, the residual labor supply to other industries (e.g., hospitals) would increase, and the wage rate paid by other industries could fall. In this latter case, not only would the wages paid by the non–dominant industries (such as hospitals) be lower than the wage paid by the dominant industry, they would also be lower than the all–industry competitive wage.

2.2.2 Theory of Inter–Industry Wage Differentials

If all industries paid the same wages to workers with similar characteristics, it would not matter from a theoretical point of view if industry-specific or all-industry wages were measured—they would be the same. Equality of wages for similar workers across industries is the outcome that is expected under competitive wage setting and free mobility of labor. But large and persistent differences have been found in the wages paid to apparently similar workers employed by different industries (Krueger and Summers, 1988). For example, hospitals have been found to pay more to nurses than they are paid by non–hospital employers (Schumacher and Hirsh, 1997). If wages paid by different industries vary, and if the mix of industries differs across areas, relative all–industry wages could differ from relative single–industry wages.

Inter–industry wage differentials pose a challenge to neoclassical wage setting theories, under which they should not exist. Neoclassical theory implies that workers' pay should depend only on their productivity (characteristics), not on what industry they work in. If differentials were present, workers would move from the lower–paying industry to the higher–paying industry until wages equalized.

Economists have advanced the following theories to explain inter–industry wage differentials (Osburn, 2000; Borjas and Ramey, 2000):

1. Unmeasured differences in worker skills, abilities, or experience. The apparent paradox of inter–industry wage differentials is only apparent, not real. When worker characteristics are fully controlled for inter–industry differences disappear.

2. Compensating differentials for job conditions. Some industries pay higher wages than others because of more difficult working conditions. For example, hospital nurses might face more stress than non–hospital nurses because they treat sicker patients. Hospitals have to pay nurses higher wages to compensate for the greater stress and responsibility of hospital jobs.

3. "Efficiency wages." This theory argues that employers may choose to pay above–market wages to increase employee productivity, for example, to reduce turnover and shirking. Employers are concerned with minimizing *total* labor costs, which are impacted by productivity, turnover, training costs, etc., not just wages paid.

4. Rent sharing. Profitable firms share some of their profits with workers in the form of higher wages. This could also occur in nonprofits, e.g., nonprofit hospitals using some of their revenues to pay their employees above–market wages. Employee labor unions may seek to obtain a share of firm profits in the form of higher wages and benefits, and may be successful.

5. Firm business decisions (worker sorting). Firms may make business decisions to compete on low costs by hiring relatively low–skill and low–wage workers, or on high productivity or quality by using higher–skilled workers who earn higher wages. The proportion of firms in each industry making such decisions could be influenced by the nature of the production process and of technology in the industry.

2.2.3 Implications for the Hospital Wage Index

What are the implications of the various theories of wage setting—including the standard competitive model and the various theories that attempt to explain inter–industry wage differentials—for the choice between hospital–specific and all–industry wages for the IPPS wage index?

The importance if not predominance of competitive wage setting factors is not controversial. Firms compete for workers and workers compete for jobs. All industries in a labor market area have to respond to the competitive market situation in hiring workers. They have to pay at least what other industries pay to attract workers, but benefit from not paying more than necessary (i.e., more than other firms) because that keeps their costs competitive.

To the extent that wage setting conforms to the standard competitive model, the choice between measuring hospital–specific or all–industry wages is not important from a theoretical point of view because they should be the same. However, as discussed further in Section 2.5, there may be empirical and policy reasons to prefer measuring all–industry wages. These include the larger and more stable sample of wages available from all industries that is less subject to the idiosyncratic peculiarities of measuring wages for only one industry (hospitals). Moreover, measuring all–industry wages avoids the circularity/incentive problems of using hospital wages to set hospital payments, and is less influenced by any deviations from competitive wage setting behavior by hospitals.

What about the implications of the theories that attempt to explain inter–industry wage differentials?

To the extent that the first two theories—unmeasured differences and compensating differentials—are true, all–industry wages may not accurately measure the wage rates faced by hospitals and thus the case for using hospital–specific wage data is strengthened. If hospitals are employing different types of workers than other industries, even within categories such as occupation that can be measured, then all–industry wages will not accurately measure the wages hospitals have to pay to attract their workers. For example, hospitals may need to hire more skilled or experienced nurses than home health agencies to treat sicker hospital patients. Similarly, if hospitals pay higher wages because of more difficult working conditions, hospital–specific wages are a more accurate measure of labor costs than all–industry wages. Hospital jobs may be more stressful or difficult than those in some other industries, so hospitals have to pay a premium to hire workers.

To the extent the latter three theories are correct—efficiency wages, rent–sharing, and business decisions—the hospital is making decisions affecting wages that are under its control. These theories imply that observed hospital wages may not reflect the market wage rate faced by hospitals. If a hospital is paying efficiency wages, it is choosing to pay above–market wages. Doing so may minimize its overall labor costs, but it is nevertheless paying more than the market wage. A hospital might also share some of its profits with its workers, especially if it is not–for–profit. If its workers are unionized, the union may be able to extract some of the hospital's profits as above–average wages paid to employees. A hospital may make business decisions to employ a lower–wage worker mix, or a higher–wage one. These decisions could be related to productivity, cost savings, or attempts to enhance quality or patient satisfaction. Some of the variations in worker characteristics that impact wages may be measurable—such as occupation—but many may not be easily measurable. Hence, observed hospital wages may deviate from market wages for workers of average characteristics.

Of course, the goal of the Medicare hospital wage index is to measure relative wage variation across areas. Even if hospital wages differ from the market wage, or if wages vary across industries, relative wages may be measured accurately if these factors operate uniformly across areas. For example, if hospital wages deviate from the market wage by approximately the same proportion in all areas, or if the industry mix is similar in most or all areas.

2.2.4 Evidence on Inter–Industry Wage Differentials

What is the evidence on the reasons for inter–industry wage differentials? An early and influential study by Krueger and Summers (1988) rejected the unobserved ability and compensating differentials hypotheses, and suggested that "workers in high wage industries receive noncompetitive rents". Murphy and Topol (1990) conclude that unmeasured individual worker characteristics is the primary explanation of inter–industry wage differentials. Gibbons and Katz (1992) find that no model of inter–industry wage differences fits all the facts. Blackburn and Neumark (1992) conclude that inter–industry wage differentials are not attributable to variation in unobserved labor quality or ability. Keane (1993) find that individual characteristics explain most inter–industry wage differences. Clearly, there is little agreement in the general empirical literature on inter–industry wage differences.

What about the medical industry specifically? Schumacher and Hirsh (1997) examine differences in hospital versus non–hospital registered nurse wages. They find that hospitals pay

RNs roughly 20 percent more. One–third to one–half of this difference is attributable to unmeasured worker ability, and the rest is probably reflects compensating differentials for hospital disamenities. Supporting these conclusions is evidence that hospital RNs have higher cognitive ability and higher–quality job experience than non–hospital RNs, and indications that shift work accounts for roughly 10 percent of the hospital premium. Sloan and Steinwald (1980) empirically evaluate Feldstein's (1971) hypothesis that hospitals share rents with employees (what Feldstein labeled "philanthropic wage setting"). Sloan and Steinwald find little empirical support for this hypothesis.

2.2.5 Wages by Hospitals and All Industries for Hospital Wage Index Occupations

We used the BLS Occupation Employment Statistics (OES) data to directly examine nationwide differences between hospital[9] and all–industry wages for the 30 occupations that MedPAC has included in its OES–based hospital wage index.[10] The results presented in ***Table 5*** show that for most occupations, especially the ones with high weights in the MedPAC index, the differences between average hospital and all–industry wages are small.[11] For example, registered nurses are paid $27.80 per hour on average by hospitals and $27.35 per hour by all industries. Even for occupations where hospitals do not dominate the labor market, the wage difference is not large. For example, hospitals pay office and administrative support workers $13.68 per hour on average versus $14.28 for all industries. Overall, the average hospital and the average all–industry wage are nearly identical for the occupations in MedPAC's hospital wage index, $20.35 for hospitals versus $20.36 for all industries.[12] These similarities lend credence to using all–industry wages to measure the wages of specific occupations used in a hospital wage index.

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9 By "hospitals" we mean "general medical and surgical hospitals."

10 See also Osburn (2000) for use of the BLS OES data to examine inter-industry wage differentials.

11 Hospital wages deviate substantially from all-industry wages for two occupations–protective service occupations and food preparation and serving-related occupations. But these occupations have small weights in the hospital wage index and are special cases. Protective service occupations includes police officers and firefighters, who are well paid, while hospital workers in this category are more likely to be low-paid security guards. Food preparation and serving occupations includes low-paid waitresses and fast-food workers, while hospital workers are more likely to include higher-paying occupations in this category.

12 Average wages are weighted by the share of each occupation in MedPAC's index.

Table 5
National Hospital and All–Industry Wages and Employment by MedPAC Hospital Wage Index Occupations, May 2005

Occupation Code	Occupation Title	% Employment Weight in MedPAC Hospital Wage Index	General Medical and Surgical Hospitals		All Industries		% Hospital in All–Industry Employment	% Difference Hospital – All Industry Wage	% Health Care in All–Industry Employment
			Employment	Wage($)	Employment	Wage($)			
All[1]	—	100.00	4,280,170	20.35	58,768,350	20.36	7.3	–0.0	20.7
11–0000	Management occupations	3.86	164,950	39.36	5,960,560	42.52	2.8	–7.4	6.8
31–0000	Healthcare support occupations	14.53	622,340	11.95	3,363,800	11.47	18.5	4.2	83.0
33–0000	Protective service occupations	0.88	37,560	13.42	3,056,660	17.19	1.2	–21.9	2.0
35–0000	Food preparation and serving related occupations	3.22	138,170	10.37	10,797,700	8.58	1.3	20.9	4.3
37–0000	Building and grounds cleaning and maintenance occupations	4.23	180,790	10.30	4,342,550	10.55	4.2	–2.4	9.1
39–0000	Personal care and service occupations	0.51	21,570	11.38	3,188,850	10.67	0.7	6.7	15.1
43–0000	Office and administrative support occupations	17.44	746,540	13.68	22,784,330	14.28	3.3	–4.2	10.5
29–1031	Dietitians and nutritionists	0.39	16,840	22.37	48,850	22.09	34.5	1.3	67.7
29–1051	Pharmacists	1.21	51,430	41.93	229,740	42.62	22.4	–1.6	26.7
29–1111	Registered nurses	31.63	1,354,020	27.80	2,368,070	27.35	57.2	1.6	84.1
29–1122	Occupational therapists	0.53	22,470	28.64	87,430	28.41	25.7	0.8	73.5
29–1123	Physical therapists	1.04	44,220	30.59	151,280	31.42	29.2	–2.6	89.8
29–1124	Radiation therapists	0.24	10,080	29.95	14,120	30.59	71.4	–2.1	95.5
29–1126	Respiratory therapists	1.73	73,830	22.15	95,320	22.24	77.5	–0.4	91.6
29–1127	Speech–language pathologists	0.24	10,160	29.15	94,660	27.89	10.7	4.5	37.8
29–2011	Medical and clinical laboratory technologists	2.21	94,690	23.36	155,250	23.37	61.0	0.0	88.9
29–2012	Medical and clinical laboratory technicians	1.45	62,430	16.53	142,330	15.95	43.9	3.6	83.6
29–2031	Cardiovascular technologists and technicians	0.76	32,150	19.50	43,560	19.99	73.8	–2.5	92.1
29–2032	Diagnostic medical sonographers	0.59	25,090	26.34	43,590	26.65	57.6	–1.2	97.7
29–2033	Nuclear medicine technologists	0.29	12,490	28.37	18,280	29.10	68.3	–2.5	94.4
29–2034	Radiologic technologists and technicians	2.54	108,790	22.64	184,580	22.60	58.9	0.2	94.5
29–2041	Emergency medical technicians and paramedics	0.88	37,870	14.05	196,880	13.68	19.2	2.7	63.1

(continued)

Table 5 (continued)
National Hospital and All–Industry Wages and Employment by MedPAC Hospital Wage Index Occupations, May 2005

Occupation Code	Occupation Title	% Employment Weight in MedPAC Hospital Wage Index	General Medical and Surgical Hospitals		All Industries		% Hospital in All–Industry Employment	% Difference Hospital – All Industry Wage	% Health Care in All–Industry Employment
			Employment	Wage($)	Employment	Wage($)			
29–2051	Dietetic technicians	0.26	11,040	13.20	23,780	12.20	46.4	8.2	83.8
29–2052	Pharmacy technicians	1.09	46,840	13.61	266,790	12.19	17.6	11.6	21.0
29–2053	Psychiatric technicians	0.25	10,820	13.90	62,040	14.04	17.4	–1.0	71.3
29–2054	Respiratory therapy technicians	0.44	19,060	18.79	22,060	18.57	86.4	1.2	95.1
29–2055	Surgical technologists	1.36	58,170	16.96	83,680	17.27	69.5	–1.8	96.7
29–2061	Licensed practical and licensed vocational nurses	4.00	171,270	16.65	710,020	17.41	24.1	–4.4	82.5
29–2071	Medical records and health information technicians	1.40	59,870	14.41	160,450	13.81	37.3	4.3	85.7
29–2099	Health technologists and technicians, all other	0.81	34,620	18.18	71,140	18.04	48.7	0.8	84.7

[1]Wages are an average weighted by each occupation's employment weight in the MedPAC hospital wage index. Employment is a sum of each occupation's employment. Hospital and healthcare shares of all industry employment are ratios of total employment.

NOTES:
1. Wages are mean hourly wages.

SOURCE: U.S. Bureau of Labor Statistics, Occupational Employment Statistics, May 2005, available at http://www.bls.gov/oes/current/oes_nat.htm#b11–0000, accessed 2–28–07.

However, particular industries do pay differently than hospitals on a national level. Wages and employment for hospitals and selected other industries for the three occupations with the largest weights in MedPAC's hospital wage index (accounting for 64 percent of the index in total) are shown in ***Table 6***. For example, nursing and residential care facilities pay RNs $24.53 per hour, 12 percent less than hospitals. On the other hand, nursing and residential care facilities pay LPNs $17.99 per hour (not shown in Table 6), eight percent more than hospitals. Because of these differences, if the mix of industries differs across areas, the all–industry wage could diverge from the hospital wage. But national wages may reflect general area wage differentials as well as industry differences, so it is not clear if these industry mix issues are ever significant empirically. Further investigation of industry mix differences in a few particular market areas and the implications for the hospital wage index could be warranted.

Table 6
National Employment and Wages for Selected Industries and Occupations

	Healthcare Support Occupations		Office and Administrative Support Occupations		Registered Nurses	
	Employment	Wage($)	Employment	Wage($)	Employment	Wage($)
General Medical and Surgical Hospitals	622,340	11.95	746,540	13.68	1,354,020	27.80
Nursing and Residential Care Facilities	1,060,230	10.11	144,840	13.17	157,870	24.53
Offices of Physicians	302,960	12.81	790,300	13.39	202,790	27.03
Educational Services	33,180	12.98	1,301,400	13.98	73,850	23.26
Federal Executive Branch	25,900	16.33	299,880	21.99	49,130	32.32

NOTE: Wages are mean hourly wages.

SOURCE: RTI analysis of May 2005 BLS Occupational Employment Statistics data.

2.3 Employment Composition of the Hospital Wage Index Occupations

We also examined the national industry employment mix of occupations included in MedPAC's alternative hospital wage index based on the BLS OES data. The BLS OES data report on workers in all industries, including hospitals. Hence, the OES mean wages for an occupation are a weighted average of the wages of hospital and non–hospital workers. In some health care occupations, most of the workers whose wages are reflected in the OES data are employed in hospitals. ***Table 5*** shows the percentage of hospital workers in all–industry employment by occupation. For example, 2.8 percent of all "management occupations" workers are employed in the hospital industry, but 57.2 percent of registered nurses are hospital workers.

The MedPAC OES hospital wage index as a whole can be thought of as an average of hospital and non–hospital wages. Multiplying the hospital employment share by each occupation's employment weight in the MedPAC index, we find that, on average, 32.4 percent of the MedPAC index is based on hospital workers. The MedPAC hospital wage index can be roughly thought of as one–third consisting of the wages of hospital employees and two–thirds consisting of the wages of non–hospital employees.

Hospitals are a subcategory of the health care industry, which also includes physician offices, nursing facilities, etc. Hospital and health care industry wages may be affected by similar forces, so it is also relevant to know how much of the MedPAC OES hospital wage index is based on employment in health care industries more broadly. ***Table 5*** shows the share of health care in all–industry employment.[13] For example, 57.2 percent of registered nurses are employed in hospitals and 84.1 percent in health care industries. Multiplying the health care employment share by each occupation's employment weight in the MedPAC index, we find that, on average, 60.4 percent of the MedPAC index is based on health care industry employees. Put another way, 32.4 percent of the index is based on hospital employees and 28.0 percent on non–hospital health care industry employees.

Occupations as well as industries can be classified as health care related or not. Health care occupations are classified into the BLS OES major occupation categories 29 Healthcare Practitioner and Technical Occupations and 31 Healthcare Support Occupations. Of the 30 MedPAC hospital wage index occupations, only six—management, protective service, food preparation and serving, building and grounds cleaning and maintenance, personal care and service, and office and administrative support, are not health care occupations.[14] The non–health care occupations comprise 30.1 percent, or about one–third, of the index. Office and administrative support occupations alone account for over one–half of the non–health care occupations, with an employment weight of 17.4 percent in the MedPAC index. In short, health care occupations account for roughly two thirds of the MedPAC BLS hospital wage index, and non–health care occupations about one third.

Putting the industry and occupation analyses together, the MedPAC BLS OES hospital wage index employment weighting can be decomposed as shown in ***Table 7***:

- 57.7 percent healthcare industry employees in healthcare occupations (of which 31.5 percent hospital employees and 26.2 percent other healthcare industry employees);
- 2.7 percent healthcare industry employees in non–healthcare occupations;
- 12.2 percent non–healthcare industry employees in healthcare occupations; and

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[13] We obtained "health care industry" employment from the BLS OES data by subtracting NAICS 624000 Social Assistance employment from "Sector 62 Healthcare and Social Assistance" employment.

[14] Table 5 shows that only these six non-health care occupations, and three health care occupations--pharmacists, pharmacy technicians, and speech-language pathologists--have less than half of their employment in the health care industry.

- 27.4 percent non–healthcare industry employees in non–healthcare occupations.

The Medicare IPPS hospital wage index, of course, is drawn totally from the hospitals, total occupations category in ***Table 7***, which accounts for only 32.4 percent of the MedPAC/BLS index. The MedPAC/BLS index draws from a much broader universe of workers including other healthcare industry workers and non–healthcare industry workers, two–thirds of which are excluded from the Medicare index. Therefore, the MedPAC index has less of a circularity issue than the current Medicare index (see Section 2.5).

Table 7
Composition of MedPAC's BLS Hospital Wage Index by Industry and Occupation Employment Proportions, in Percents

	Healthcare Industry		Non–Healthcare Industry	Total Industries
	(Hospitals)	(Other)		
Healthcare Occupations	57.7		12.2	69.9
	(31.5)	(26.2)		
Non–Healthcare Occupations	2.7		27.4	30.1
	(0.9)	(1.8)		
Total Occupations	60.4		39.6	100.0
	(32.4)	(28.0)		

NOTE: The table analyzes weighted average employment proportions of the 30 occupations included in MedPAC's hospital wage index by industry and occupation category. To derive the weighted average proportions, each occupation's proportion in a category is weighted by its employment share in MedPAC's index. Hospitals are general medical and surgical hospitals.

SOURCE: RTI analysis of May 2005 BLS Occupational Employment Statistics data.

Of these four categories of employment in MedPAC's index, it seems reasonable to hypothesize that only the last (non–healthcare industry employees in non–healthcare occupations) might diverge substantially from the wages paid in hospitals in particular areas. But non–healthcare workers in non–healthcare occupations comprise only about one–quarter of the MedPAC/BLS hospital wage index. So any deviations that occur will not have a large effect on the index. For instance, if wages for this category were 20 percent greater than the wages paid by hospitals, the index would be raised only by (20 percent) X (27.4 percent) = 5.5 percent. Moreover, it is not clear that if hospital and all–industry wages diverge that it is preferable to use hospital wages in the Medicare wage index (see Section 2.5 for discussion).

2.4 Evidence on Factors Affecting the Hospital Average Wage

Pope and Adamache (1993) analyzed factors affecting hospital average hourly compensation, the basis for Medicare' IPPS hospital wage index. They found that the following seven factors explain about 70 percent of the variation in individual hospital average hourly compensation:

- Area opportunity wage (i.e., the amount hospital workers could earn in alternative occupations in an area);
- Area hospital–specific wages;
- Hospital size;
- Hospital casemix;
- Hospital occupation mix;
- Hospital unionization; and
- The competitiveness of the area labor market.

The largest influence on hospital wages was opportunity wages, but the other factors, especially considered as a group, had a large impact. An important hospital–specific component to wages was found, which does not favor the use of an opportunity wage alone to measure hospital wages in different geographic areas. Pope and Adamache argue that the effects of occupation mix (and any other worker characteristics), casemix, and hospital size on the wage index (which are thought to reflect primarily unmeasured worker characteristics) should be removed. This is because the need for different worker characteristics is reimbursed through the DRG casemix and teaching adjustments to hospital payments. The effects of competition on the index should not be removed, because this is a structural market factor beyond the control of hospitals. Whether the effects of unions should be removed is a policy decision.

It is not clear whether the CMS Hospital Wage Survey data or the BLS OES data best reflects the appropriate factors influencing hospital wages, while not reflecting the undesirable factors. Both data should measure the area opportunity wage. The CMS survey will better measure area hospital–specific labor market factors, although, as argued above, the BLS OES data include a significant hospital– and healthcare–industry–specific component. The BLS OES data will be better than the CMS hospital wage survey data at avoiding measuring the effects of hospital size, casemix, occupation mix, unionization, and area competition for healthcare workers.

2.5 Arguments For and Against the Use of Hospital–Specific Versus All–Industry Wage Data

In this section, we list arguments for and against the use of hospital–specific (CMS Hospital Wage Survey data) and all–industry (BLS OES wage data) wages in the IPPS hospital wage index. These arguments draw on the discussion in the preceding sections, and on additional considerations such as characteristics of the two alternative data sources. These arguments are not meant to be comprehensive of all advantages and disadvantages of alternative approaches, but are particularly salient points to make in the context of the discussion in this paper.

In the following discussion, it should be kept in mind that factors that affect absolute wages do not necessarily affect relative wages. Factors that affect absolute wages will only affect

relative wages if they operate non–uniformly across market areas. For example, if the industry mix varies across areas. Measuring relative wages accurately is the goal of the IPPS wage index.

2.5.1 Arguments for Using Hospital–Specific Wage Data in the IPPS Hospital Wage Index

This section presents arguments in favor of using hospital–specific wage and compensation data, such as data from CMS' Hospital Wage Survey, to construct the IPPS hospital wage index.

1. Supply and Demand Factors Specific to the Market for Hospital Labor are Captured. Every industry, even every employer, may face specific, exogenous supply and demand factors that affect the wages it has to pay to attract workers. These hospital–specific factors should ideally be reflected in the hospital wage index. For example, hospital nursing jobs might require more skill, or be more demanding or stressful than nursing jobs in other industries, and thus hospitals may have to pay a premium relative to other industries to employ nurses. Hospitals may require more night shift work that may require higher wages as a compensating differential. Hospital–specific factors will only be important for a *relative* wage index if they apply differentially across areas.

2. Factors Specific to Markets for Non–Hospital Labor are Not Reflected. Limiting the hospital wage index to hospital wage data avoids "contamination" from factors affecting wages paid in other industries. For example, all–industry wages in an area with a concentration of large, unionized manufacturing firms may exceed the wages hospital need to pay to hire their workers. The above–market wages paid by unionized manufacturing firms should not be reflected in the hospital wage index. Also, industries that are concentrated in certain areas may employ certain specialized types of labor within broader occupational categories whose wages are not representative of hospitals or even the occupational category as a whole. In general, hospitals compete with other industries for labor and wages should be similar, but there may be distortions of the normal competitive market for labor in some instances.

3. The hospital–specific mix of workers is reflected. Hospitals may disproportionately employ certain specific types of labor within the broader occupation categories for which wages can be measured in available data. These broader labor categories may not accurately reflect the worker–mix or wages of hospital employees. Again, even if this affects *absolute* wages, it is not clear that it would affect *relative* wages.

2.5.2 Arguments for Using All–Industry Wage Data in the IPPS Hospital Wage Index

This section presents arguments in favor of using all–industry wage data, such as data from the BLS OES, to construct the IPPS hospital wage index. Note that, as discussed above, the BLS data are really an average of hospital–specific and non–hospital wages. For healthcare occupations, the BLS data reflect a large share of hospital–specific data. Over all the 30 occupations in MedPAC's BLS–based index, about one–third of the wages are based on hospital

employees. In this section, we focus on the arguments for including the two–thirds of non–hospital–employee data in the IPPS hospital wage index.

1. Hospital wages are not fully "passed through" into Medicare payments. With a hospital–specific wage index, a hospital's area wage index, and thus its Medicare payments, can be influenced by the wages it pays. This may reduce the incentive of hospitals to bargain hard with its workers over compensation, and pay the lowest wages necessary to attract and retain employees. This incentive problem is exacerbated in smaller MSAs with only one or a few hospitals, and for hospitals with a larger Medicare share of business. Hospitals are included in an all–industry wage, but they are only one component, along with other industries.

2. Noncompetitive factors in hospital wage setting are avoided. To the extent that hospitals pay noncompetitive—above market—wages, a hospital–specific wage index will not reflect the true relative cost of labor faced by hospitals. Hospitals may pay noncompetitive wages for a variety of reasons, including sharing surpluses with employees, unionization of the hospital workforce, misjudging or lack of information about the market wage, or business decisions. All–industry data will be less influenced by these factors.

3. Worker skill–mix variations related to differences in hospital outputs or business decisions are not reflected. Hospitals that treat particularly difficult cases may require highly skilled and specialized workers, even within occupational category, that are paid above–average wages. The labor costs associated with a more difficult casemix should be reflected in a hospital's DRG casemix, not in its wage index. Also, hospitals may make business decisions about their labor skill mix, or to offer specialized services or technology requiring highly–paid workers, that affect their average wage. The IPPS wage index should ideally be neutral with respect to hospital business decisions. An index incorporating non–hospital wage data will be less influenced by hospital–specific skill–mix variations.

4. The broader base of all–industry data makes it less subject to reporting errors, idiosyncratic factors, and volatility. By definition, all–industry wage data are collected from a larger universe of firms and workers. This broader base makes all–industry data less subject to reporting errors by individual hospitals, and idiosyncratic or nonrepresentative wages paid by hospitals. Also, the all–industry wage data should be more stable from year–to–year; it will not be as influenced by discontinuous wage changes at hospitals or other one–time changes.

3.0 AREA WAGE INDEXES IN OTHER MEDICARE PROSPECTIVE PAYMENT SYSTEMS

3.1 Other PPS Settings Using Hospital Relative Wages

Since 1997 Medicare prospective payment systems have been extended from inpatient hospital services to services in several other institutional payment settings. Although setting–specific wage data are collected for several of these settings, the new PPSs continue to use the hospital wage index to adjust payments. For each new payment system CMS sets a specific labor–related share of payments to be subject to area wage adjustment. Thus far CMS has decided against computing new relative wages using hourly setting–specific wage data.

In most cases the new PPS use a "pre–floor, pre–reclassification" version of the index rather than the published IPPS index (the exception being for hospital outpatient payments). Since 2005, the version of the index with partial occupation mix adjustment has been used for payments for other specialized hospital services, while the non–adjusted version is used for non–hospital settings such as skilled nursing, home health and hospice. Specific prospective payment settings using the hospital wage index are listed below in ***Table 8***.

Table 8
Use of the Hospital Area Wage Index in Other Medicare Prospective Payment Systems

Health Care Setting	Index Description
Inpatient services:	
Inpatient Rehabilitation Facilities (IRF)	Pre–floor, pre–reclassification, occupation–mix adjusted index without outmigration adjustment.
Inpatient Psychiatric Facilities (IPF)	Pre–floor, pre–reclassification, occupation–mix adjusted index without outmigration adjustment.
Long Term Acute Care Hospitals (LTCH)	Pre–floor, pre–reclassification, occupation–mix adjusted index without outmigration adjustment. Index was phased in over a 5–year period due to lack of evidence on relationship between the index and case–mix–adjusted average cost per discharge.
Inpatient nursing care:	
Skilled Nursing Facilities (SNF)	Pre–floor, pre–reclassification index without occupation–mix or outmigration adjustments.
Outpatient and home–based settings	
Hospital outpatient services (HOPD)	Uses the same index that is applied to the hospital's inpatient services.
Ambulatory Surgery Centers (ASC)	Pre–floor, pre–reclassification index without occupation–mix or outmigration adjustments.
Home Health (HHA)	Pre–floor, pre–reclassification index without occupation–mix or outmigration adjustments.
Hospice	Pre–floor, pre–reclassification index without occupation–mix or outmigration adjustments.

SOURCE: RTI synopsis of Federal Registers and other sources.

3.2 Labor Market Comparability and Other Issues

The major drawbacks to using acute care hospital relative wages as adjusters for non–hospital health care payments are that (1) acute care area wage differences may be heavily influenced by differences in occupation mix that are not applicable to other settings; (2) there are many markets, including even some state rural markets, where the hospital index values are computed from data submitted by only one or two facilities; and (3) non–hospital providers to which the hospital wage index is applied may be located in counties without hospitals, hence their wage index is based on wage data that are not specific to the area in which they are located.

With respect to occupation mix influences, previous work has estimated that as much as one–fourth of the rural–urban hourly wage differentials might be due to occupation mix differences associated with smaller facilities with less complex case loads (Dalton and Slifkin 2000). These differentials may not apply to settings with distinctly different employment mixes such as nursing homes or home health agencies, where similar urban–rural differences in firm size, complexity, or case mix may not apply. The proposed use of BLS all–industry hourly wages with separate employment weights by industry setting would address this issue.

Small market problems stem from the fact that the index uses data only from IPPS hospitals. In larger metropolitan areas it is reasonable to assume that relative wages may be dominated by the hiring practices of these larger facilities. In smaller markets, however, local market conditions may be influenced as much or more by wages paid in nursing homes, critical access hospitals, outpatient facilities, specialized hospitals or even federally–owned facilities (IHS or VA). Also, some non–hospital providers are located in counties without hospitals, and thus there are no hospital wage data available to accurately measure wages in their locale. Thus the IPPS relative wages may not reflect the market differences or geographical locations relevant to non–hospital providers. The use of the BLS all–industry data would also address these issues.

Exacerbating these problems is the fact that there are no provisions to allow for geographic reclassification for non–IPPS providers. SNF PPS rules call for reclassification to be made available whenever a SNF–specific wage index is developed. Although CMS computed a SNF wage index for evaluation, they have postponed its use (citing data quality problems) and therefore delayed introducing any reclassification procedures for nursing facilities (68 FR 46046, August 4, 2003).

4.0 DATA QUALITY AND VOLATILITY ANALYSIS OF CURRENT AND ALTERNATIVE WAGE INDEXES

4.1 Overview

This chapter compares the volatility of a wage index constructed from the BLS Occupational Employment Statistics (OES) data to CMS hospital wage index values. We construct an index using the BLS mean hourly rates from the metropolitan area cross—industry wages and the national industry—specific weights applicable to general hospitals. We compare volatility in this index over six years to volatility in a published CMS index applicable to payments in urban PPS hospitals for this same time period. We also compare volatility for a similar time period in wage, benefit, and total compensation indexes constructed from CMS' hospital wage survey. Prior analysis by MedPAC found evidence that a BLS wage index exhibits less volatility than the CMS IPPS area wage index. We extend MedPAC's analysis by using more years of data, by utilizing additional measures of volatility, and by exploring the contribution of reported benefits to overall volatility in the CMS index. We also use the CMS hospital wage survey data to analyze trends and regional variation in the ratio of benefits to total compensation.

Section 4.2 describes our methods, including the composition of the data series, the construction of an alternative BLS index, and our approaches to measuring volatility. Results from our analysis of volatility in the BLS series compared to the CMS series are presented in ***Section 4.3***. ***Section 4.4*** discusses possible sources of volatility and data quality issues, and includes a comparison of the volatility of indexes of wages, benefits, and total compensation. ***Section 4.5*** contains results on geographic and temporal variation in benefits as a proportion of total compensation.

4.2 Methods

4.2.1 Data Sources and Timing

Data sources include the following:

1. the BLS' published OES occupation survey data from 1999 through 2004;

2. published CMS wage index values from *payment years* FY1999 to FY 2004; and

3. CMS' annual hospital wage surveys derived from cost reports filed from FY 1999 through FY 2004.

The six payment years for the published CMS wage index correspond to data collection from cost reports filed between FY 1996 to FY 2000, and thus only partially overlap the data collection periods for the other two wage series. Although published index values from FY 2003 through FY 2008 would have provided a better overlap with the BLS data collection periods, we could not use these because CMS adopted the new CBSAs to define labor markets starting in 2005.

The BLS occupational wage series has a three–year survey structure. Each published year of data includes results from six surveys taken over three survey years, where the earlier data are inflation adjusted to reflect the price levels of the third year. Wage series are published in May of the year following the last survey year. For example, what we refer to as the 2004 BLS data were released in May of 2005, and were composed of results from two surveys in 2004, two in 2003 and two in 2002. The timing of the data publication is such that the 2004 BLS data could be used to construct an index to adjust PPS payments no earlier than federal FY 2007.

Although the BLS data series is constructed from a rolling sample design, it should not be confused with a standard moving average using repeated employer measures. While the full sample covers some 1.2 million establishments employing approximately 70 percent of the workforce, in any given year only one–third of the establishments are surveyed.[15] Data for prior years (e.g., the surveys from 2002 and 2003 that contribute to the "2004" series) are updated to reflect 2004 labor dollars using the Employment Cost Index.[16]

We compare volatility measures with those computed from published CMS index values for payment years FY1999 to FY2004 (data years FY1996 to FY2000). We could not synchronize the BLS index with the CMS published index—either on the basis of data years or payment years—for two reasons. First, we were limited to published index years during which CMS used pre–CBSA definitions of metropolitan areas (index years FY 2004 and earlier). Second, we were limited to years when BLS national industry–specific hourly wages were available for all of the occupation categories (data years 1999 and later). Prior to 1999 the BLS did not publish data on aggregate occupational categories (e.g., xx–0000) within specific industry sectors, making it infeasible to construct compatible employment weights for pre– and post–1999 data.

We also use CMS wage survey data from cost reports filed FY 1999 through FY 2004 to construct a "wages–only" index that excludes the reported benefits and contract labor. This constructed CMS index is the closest possible match to the BLS series both from the timing of the data collection and the definition of hourly wage.

4.2.2 Wage Index Areas for Comparison

The volatility comparisons in this chapter are based on changes in metropolitan markets only, because the BLS does not publish occupational wage survey data for state–level aggregates of non–metropolitan counties.[17] The number of metropolitan markets in our analyses was reduced further due to missing hourly wages in the BLS series. BLS suppresses publication of

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15 See "Why does the OES program produce estimates from more than one year's data?" at http://www.bls.gov/oes/oes_ques.htm

16 See "Permanent features of OES methodology" at http://www.bls.gov/oes/oes_ques.htm

17 Data for state-level aggregates are published, but it would not be appropriate to subtract the employment totals for metropolitan areas from those of state areas, because many MSAs cross state boundaries. Although not publicly available, BLS can generate special runs to identify state-level non-metropolitan employment and wage data appropriate to Medicare's defined rural markets.

local wage information on specific occupations if the survey data are based on information from fewer than three employers in the MSA (to protect confidentiality of responses), or if the standard errors of the estimate are too large (whether due to small response numbers or other reasons).[18] Missing data were found for several occupation categories over different MSAs and data years, and in consultation with the project officer a decision was made to exclude any MSA from the volatility analyses that did not have RN wages in all six of the analysis years. For all other missing categories, weights were re–normalized to adjust for the missing data. Excluding MSAs with missing RN data in the BLS series reduced the number of metropolitan markets in our analyses from 318 to 264.

CMS data were restricted to the same MSA sample as the BLS data. The number of metropolitan markets in the CMS data is slightly lower than the number in the BLS series because prior to 2005, CMS used NECMAs (New England County Metropolitan Areas) to define labor markets in New England. A single NECMA may correspond to multiple MSAs. In the end, our analysis was based on 264 wage index areas for the BLS data and 251 comparable wage index areas for the CMS data.

4.2.3 BLS Wage Index Construction

The BLS data series used here focuses on occupation codes found in the 'all hospitals' category (NAICS 622000) rather than General Medical and Surgical Hospitals category (NAICS 622100). The reason for this is that prior to 2002 BLS used the SIC system, which did not break out General Medical and Surgical Hospitals from other hospitals. Comparability over the entire time period required the use of the more aggregated category.[19]

To construct the hospital indexes for these analyses we used twenty–nine of the thirty occupational categories used by MedPAC in its proposed BLS index.[20] These are occupations that are (a) prevalent in general acute care hospital facilities, and (b) included as allowable Part A costs under IPPS (occupations that are primarily reimbursed through Medicare Part B rather than through the IPPS rates are excluded). The twenty–nine categories combined account for approximately 87 percent of total employment in the BLS data for the hospital industry group, with specific category weights ranging from 31 percent to 0.2 percent. As shown in ***Table 9***, the share of hospital employment by occupation category is fairly stable over time, although changes in these shares do contribute to BLS index volatility over time.

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[18] This restriction affects only our volatility analyses and not the potential to compute a wage index. Data that are suppressed to protect employer confidentiality (rather than due to sampling error) can still be provided by BLS for purposes of constructing the wage index. The majority of those with missing RN data are in relatively small MSAs, and we assume that the data were suppressed to protect confidentiality of responding employers.

[19] Also of note is that in 2002 BLS did not publish the 3-digit NAICS data (e.g., NAICS 622000); as a result, the data used here for 2002 was aggregated from the published 4-digit NAICS data (e.g., 622100, 622200, etc.).

[20] Code 29-2099, for "health technologists and technicians, all other", was published for the first time in 2004. It accounted for only 0.72 percent of hospital employment total in 2004, but to maximize consistency over time this category was dropped.

Table 9
General Hospital Employment–Share Weights for Key Occupations, 1999–2004

CODE	Description	BLS Data Year 1999	2000	2001	2002	2003	2004
Detailed occupation categories:							
29–1111	registered nurses	25.7%	25.9%	25.9%	26.3%	26.6%	26.9%
29–2061	licensed practical and vocational nurses	4.0%	3.9%	3.9%	3.9%	3.8%	3.7%
29–2034	radiologic technologists and technicians	1.9%	2.0%	1.9%	2.0%	2.0%	2.0%
29–2011	medical and clinical laboratory technologists	1.8%	1.8%	1.7%	1.8%	1.8%	1.8%
29–1126	respiratory therapists	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%
29–2012	medical and clinical laboratory technicians	1.2%	1.3%	1.3%	1.2%	1.3%	1.2%
29–2071	medical records and health information technicians	1.1%	1.1%	1.1%	1.1%	1.1%	1.2%
29–2055	surgical technologists	1.0%	1.1%	1.1%	1.1%	1.1%	1.1%
29–1051	pharmacists	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
29–1123	physical therapists	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%
29–2052	pharmacy technicians	0.8%	0.9%	0.9%	0.9%	0.9%	0.9%
29–2041	emergency medical technicians and paramedics	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
29–2053	psychiatric technicians	0.8%	0.7%	0.9%	0.7%	0.7%	0.7%
29–2031	cardiovascular technologists and technicians	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%
29–1122	occupational therapists	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
29–2032	diagnostic medical sonographers	0.4%	0.4%	0.4%	0.4%	0.4%	0.5%
29–2054	respiratory therapy technicians	0.6%	0.5%	0.5%	0.5%	0.5%	0.4%
29–1031	dietitians and nutritionists	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
29–2033	nuclear medicine technologists	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
29–2051	dietetic technicians	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%
29–1127	speech–language pathologists	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
29–1124	radiation therapists	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Major (aggregated) occupation categories:							
43–0000	office and administrative support occupations	15.0%	15.1%	15.4%	15.3%	15.4%	15.3%
31–0000	healthcare support occupations (aides)	12.8%	12.7%	12.8%	12.9%	13.1%	13.2%
37–0000	building & grounds cleaning & maintenance	4.0%	3.9%	3.9%	3.9%	3.9%	3.8%
11–0000	management occupations	4.1%	3.9%	3.8%	3.7%	3.5%	3.5%
35–0000	food preparation and serving related occupations	3.1%	3.0%	3.0%	3.0%	3.0%	2.9%
33–0000	protective service occupations	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%
39–0000	personal care and service occupations	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Total BLS employment share for included general hospital occupation categories		85.9%	85.8%	85.9%	86.3%	86.7%	87.0%
Total excluded occupation categories		14.1%	14.2%	14.1%	13.7%	13.3%	13.0%

SOURCE: RTI analysis of BLS Occupational Employment Statistics data.

The BLS wage index was constructed by dividing an estimate of the MSA–specific 'mean wage' for hospitals with an estimate of the national mean wage for hospitals. The MSA–specific 'mean wage' is a misnomer, in that it does not attempt to estimate the mean wage actually paid to hospital employees. First, the estimate is constructed using only the 29 occupational categories described above. Second, the mean wage rates in these 29 categories are weighted by the *national* (as opposed to local) employment shares of these 29 occupations in the hospital industry.[21] This approach eliminates differences in index values due to variations in the employment shares of the occupations across MSAs. The national mean wage used as a denominator for the index is the weighted average mean wage generated using the 29 occupational categories with national employment weights and national mean wages by occupation.

Many of the 264 MSAs used in our analysis are missing some occupational wage data in one or more years. In these cases we proportionally increased the (national) wage bill shares of the occupations with reported wage data to equal 100 percent for the area with missing data. This procedure implicitly assumes that the relative wages of the missing occupations were the same as the average relative wage of the occupations with reported data (weighted by their wage bill shares). As a sensitivity analysis, we tried a second normalization for missing data based on employment rather than wage shares, but the second normalization had very little impact on the final index numbers.

4.2.4 CMS Wage Index Construction

MSA Published Values

MSA values for the CMS wage index were taken directly from the CMS' wage history file that accumulates index values by MSA by covered period. We had intended to use a pre–reclassification, pre–floor index. However, the two indexes available in CMS' wage history file are both post–reclassification. We used the one calculated for hospitals that are located in the index area and hospitals that were reclassified into the area and had average wages at least as high as the average wages of the hospitals located in the area. The MSA value of the wage index is based on the average wages of all such hospitals. The other wage index in CMS' file, that we did not use, is for hospitals that have been reclassified into the area but whose average wages are less than average wages of the hospitals located in the area. Both wage indexes in the CMS file, including the one we used, reflect wage floors that might have applied. Where there were multiple records in the CMS wage index history file for a given MSA/year (for example, due to CMS mid–year updates), we used the latest index values for that year. For the volatility analysis, CMS wage index values were used for each urban labor market (or NECMA aggregation) that was included in the BLS data.

[21] If there are no missing data by occupation, this approach is mathematically equivalent to weighting local relative wages (i.e., local wages divided the national average in each category) by the national wage bill share of each occupation for the industry.

Indexes Constructed from Hospital–Level Data

We also constructed indexes of wages, benefits, and total compensation from the hospital–level wage and hour data made available on the CMS web site. These data are from the IPPS provider cost reports, and are the files used by CMS to construct the hospital wage index for payment years 2003 through 2008. The data years are comparable to the data years for the BLS series. The downloaded files contain data that have been edited to remove extreme values and the wages have been price–adjusted (using the BLS employment cost index) to reflect a common accounting period ending date of December 31 for each year. None of the CMS hourly wage series are adjusted for occupation mix.

We grouped provider data by MSA and constructed indexes for PPS relative wages and PPS relative total compensation, using measures S3 Part III line 3 (for PPS wages); and S3 Part III line 6 (for PPS compensation including contract labor and benefits). Local average wages were calculated as the sum of market wages divided by the sum of market hours. Aggregate average national hourly wages and hourly total compensation were computed for each year from data on all providers in all markets. To be able to compare geographic variation in benefits distinct from variation in base wages, we also computed MSA–level measures of average hourly benefits and benefits as a percent of total hourly compensation.

4.2.5 Measures of Volatility

We explored several measures of volatility both over time and across markets. Range and percentile distributions of index values are presented to examine differences in stability across the data sources. We also computed the annual percent changes in index values for each MSA over the six–year study period, and the distribution of markets by the level of change. For each MSA, we computed two study–period summary measures: the first is a mean of the absolute values of the five annual change measures, and the second is the MSA–level standard deviation (computed over six observations, one for each year).

4.3 Volatility of the Published CMS Wage Index Versus the BLS Wage Index

Volatility, or temporal variation in the computed index values, is captured by examining both the year–to–year percent change in individual MSA index values over the six years of data, and by computing a single measure of dispersion for each labor market, the standard deviation of the index across all six years of data. In the results presented below, it was found that the CMS wage index usually exhibited more volatility than the BLS wage index. The difference in volatility, however, was not dramatic.

4.3.1 Distribution of Index Values for Each Year, 1999–2004

First we examined the overall distributions of the CMS and BLS indexes for any evidence of volatility. The CMS wage index distribution is stable over time. It has stable minimum and maximum values that range each year from about 0.76 to about 1.52 (***Table 10***). Likewise the means (0.97), the medians (0.94), and standard deviations (0.13) were stable, as were the other quantile measures such as the first (25%) quartiles and third (75%) quartiles. The distributions of the BLS wage indexes (***Table 11***) were also stable with the exception of a slight upward movement of the maximum value from 1.32 in 1999 to 1.41 in 2004. As indicated by its

larger annual standard deviation and its higher maximum values, the CMS wage distributions are slightly more spread out than the BLS wage distributions. The fact the CMS wage indexes were based on total compensation (salaries plus fringe benefits) whereas the BLS wage indexes were based on just salaries could have contributed to this finding. The overall distributions of the CMS and BLS indexes are stable and similar and show little evidence of volatility.

Table 10
CMS IPPS Area Wage Index Distributions for MSAs with BLS RN Wage Data, 1999–2004

	Payment (Data) Year*					
Quantile	1999 (1995)	2000 (1996)	2001 (1997)	2002 (1998)	2003 (1999)	2004 (2000)
100% (Maximum)	1.52	1.51	1.50	1.53	1.52	1.51
99%	1.45	1.45	1.45	1.44	1.44	1.45
95%	1.21	1.24	1.20	1.21	1.24	1.22
90%	1.14	1.14	1.13	1.13	1.13	1.13
75%	1.02	1.02	1.02	1.02	1.04	1.03
50% (Median)	0.93	0.93	0.94	0.95	0.94	0.94
25%	0.87	0.87	0.88	0.88	0.89	0.89
10%	0.83	0.84	0.84	0.84	0.85	0.84
5%	0.81	0.81	0.82	0.81	0.81	0.82
1%	0.77	0.78	0.77	0.78	0.79	0.78
0% (Minimum)	0.76	0.77	0.77	0.74	0.77	0.78
Mean – unweighted	0.97	0.97	0.97	0.97	0.98	0.97
Standard deviation	0.13	0.13	0.13	0.13	0.13	0.13
Number of MSAs	251	251	251	251	251	251

* The payment year is on top and the data year is in parentheses below the payment year.

NOTE: Published IPPS area wage indexes (see text).

SOURCE: RTI analysis of CMS Wage Index History file through Federal Fiscal Year 2004.

COMPUTER OUTPUT: wa_medpac_r2_march06.log (3–8–07)

Table 11
BLS Area Wage Index Distributions for MSAs with RN Wage Data, 1999–2004

	BLS Data Year					
Quantile	1999	2000	2001	2002	2003	2004
100% (Maximum)	1.32	1.34	1.35	1.36	1.38	1.41
99%	1.30	1.32	1.33	1.33	1.33	1.33
95%	1.17	1.16	1.16	1.16	1.15	1.17
90%	1.13	1.12	1.13	1.12	1.12	1.13
75%	1.02	1.02	1.02	1.03	1.03	1.03
50% (Median)	0.94	0.94	0.94	0.95	0.94	0.94
25%	0.88	0.88	0.89	0.89	0.89	0.89
10%	0.84	0.84	0.84	0.85	0.85	0.84
5%	0.82	0.83	0.83	0.83	0.82	0.83
1%	0.80	0.78	0.80	0.79	0.79	0.79
0% (Minimum)	0.78	0.73	0.76	0.76	0.76	0.78
Mean – unweighted	0.96	0.96	0.96	0.96	0.96	0.97
Standard deviation	0.11	0.11	0.11	0.11	0.11	0.11
Number of MSAs	264	264	264	264	264	264

SOURCE: RTI analysis of BLS Occupational Employment Statistics data.

COMPUTER OUTPUT: kd_medpac3_fama_march07.log

4.3.2 Distribution of Annual Percent Changes in Index Values, 2000–2004

Next, we examined volatility for individual wage index areas by calculating the annual percent change in both the CMS and BLS wage indexes for each wage index area (MSA) for each year from 2000 to 2005.[22] For year 2000 the percent change is from 1999 to 2000 and so forth for each subsequent year. The distributions of the annual percent changes for each year are shown in ***Tables 12 and 13***. Although the annual wage index changes for most areas are small, some areas experience large changes in any year. The largest increases in the CMS wage index range from 13.2 to 16.0 percent while largest increases in the BLS wage indexes range from 9.4 to 20.8 percent. The largest decreases in the CMS wage index range from –7.0 to –14.2 percent while the decreases in the BLS wage index range from –4.0 to –14.0 percent. The first and third

[22] The annual percent change is equal to the difference between the current year's wage index and the previous year's index, divided by the previous year's index and multiplied by 100.

quartile changes, covering 50 percent of the market areas, were larger in absolute value in the CMS wage index than in the BLS wage index. The standard deviations of the changes were also larger in the CMS wage index than in the BLS wage index. The CMS wage index exhibited more annual volatility than the BLS wage index, but not by a large amount.

Table 12
Distribution of Annual Percent Changes in CMS's IPPS Wage Indexes for MSAs that have BLS RN Wage Data, 2000–2004

	Payment (Data) Year*				
Quantile	2000 (1996)	2001 (1997)	2002 (1998)	2003 (1999)	2004 (2000)
100% (Maximum)	15.1%	15.2%	13.2%	14.3%	16.0%
99%	10.9%	6.9%	11.0%	9.1%	7.4%
95%	6.2%	5.1%	6.2%	4.7%	3.7%
90%	4.7%	3.4%	4.2%	3.3%	2.8%
75%	2.2%	1.8%	2.2%	2.2%	1.4%
50% (Median)	–0.1%	0.2%	0.3%	0.2%	–0.1%
25%	–1.9%	–1.6%	–1.4%	–1.4%	–1.7%
10%	–4.2%	–3.3%	–2.9%	–3.0%	–4.3%
5%	–5.0%	–5.0%	–4.4%	–4.0%	–5.5%
1%	–9.5%	–6.5%	–6.3%	–6.4%	–7.7%
0% (Minimum)	–11.9%	–9.3%	–9.4%	–7.0%	–14.2%
Mean – unweighted	0.2%	0.1%	0.6%	0.4%	–0.3%
Standard deviation	3.7%	3.0%	3.2%	2.9%	3.1%
Number of MSAs	251	251	251	251	251

*The payment year is on top and the data year is in parentheses below the payment year.

NOTES: Published IPPS area wage indexes (see text).

SOURCE: RTI analysis of CMS Wage Index History file through Federal Fiscal Year 2004.

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Table 13
Distribution of Annual Percent Changes in the BLS Area Wage Indexes for MSAs That Have RN Wage Data, 2000–2004

	BLS Data Year				
Quantile	2000	2001	2002	2003	2004
100% (Maximum)	19.9%	13.9%	20.8%	12.8%	9.4%
99%	9.5%	7.6%	8.5%	6.0%	8.7%
95%	4.9%	4.9%	3.1%	2.6%	5.5%
90%	3.4%	3.3%	1.6%	1.7%	3.5%
75%	1.9%	1.2%	0.5%	0.7%	1.4%
50% (Median)	0.0%	0.2%	–0.2%	–0.2%	0.0%
25%	–2.0%	–0.7%	–1.0%	–0.9%	–1.3%
10%	–4.0%	–1.5%	–1.8%	–1.7%	–2.4%
5%	–6.0%	–2.2%	–2.4%	–2.0%	–3.7%
1%	–10.9%	–3.8%	–3.6%	–5.0%	–6.8%
0% (Minimum)	–14.0%	–11.6%	–4.0%	–6.4%	–13.3%
Mean – unweighted	–0.1%	0.5%	0.0%	–0.1%	0.2%
Standard deviation	3.6%	2.4%	2.1%	1.7%	2.7%
Number of MSAs	264	264	264	264	264

SOURCE: RTI analysis of BLS Occupational Employment Statistics data.

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4.3.3 Distribution of Annual Absolute Percent Changes in Index Values, 2000–2004

The absolute values of annual percent changes for each MSA were also calculated for both the CMS and BLS wage indexes over the period 2000–2004. A frequency distribution by size of change is shown in ***Table 14***. Across all years combined, there was a higher percentage of larger changes in the CMS index than the BLS index. In the CMS index, 1.3 percent of MSA/year changes were 10 percent or greater, compared to 0.9 percent for the BLS index. Similarly, 8.8 percent of the CMS changes were 5 to 10 percent, while only 4.8 percent of the BLS changes were as large. Over 80 percent of the BLS index MSA/year changes were smaller than 2.5 percent, compared to less than 65 percent of the CMS index changes. These statistics indicate somewhat greater volatility in the CMS index than in the BLS index.

Table 14
Distribution of Annual Absolute Percent Changes in CMS's IPPS Wage Indexes and the BLS Wage Index for MSAs with BLS RN Wage Data, 2000–2004

Annual Absolute Percent Change from Previous Year	CMS Payment (Data) Year*										Combined Single Year Changes	
	2000 (1996)		2001 (1997)		2002 (1998)		2003 (1999)		2004 (2000)			
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
10% or more	5	2.0	1	0.4	4	1.6	2	0.8	4	1.6	16	1.3
5% to 9.99%	32	12.8	24	9.6	22	8.8	15	6.0	17	6.8	110	8.8
2.5% to 4.99%	72	28.7	64	25.5	62	24.7	64	25.5	54	21.5	316	25.2
0% to 2.49%	142	56.6	162	64.5	163	64.9	170	67.7	176	70.1	813	64.8
Number of MSAs	251	100.0	251	100.0	251	100.0	251	100.0	251	100.0	1,255	100.0
	BLS (Data) Year										Combined Single Year Changes	
	2000		2001		2002		2003		2004			
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
10% or more	6	2.3	3	1.1	1	0.4	1	0.4	1	0.4	12	0.9
5% to 9.99%	23	8.7	10	3.8	5	1.9	5	1.9	20	7.6	63	4.8
2.5% to 4.99%	69	26.1	34	12.9	22	8.3	19	7.2	40	15.2	184	13.9
0% to 2.49%	166	62.9	217	82.2	236	89.4	239	90.5	203	76.9	1,061	80.4
Number of MSAs	264	100.0	264	100.0	264	100.0	264	100.0	264	100.0	1,320	100.0

* The payment year is on top and the data year is in parentheses below the payment year.

NOTE: CMS values from published IPPS area wage indexes (see text).

SOURCE: RTI analysis of CMS Wage Index History File through Fiscal Year 2004 and BLS Occupational Employment Statistics data.

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While a greater share of MSAs experienced larger changes in the CMS wage indexes than in the BLS wage indexes, the share of MSAs in the smallest CMS change group (0 to 2.49%) steadily increased from 57 to 70 percent between 2000 and 2004. In contrast, there were large changes in the share of MSAs in the smallest BLS change group. The share in 2000 was 63 percent and then jumped to 82 percent in 2001, and then again to about 90 percent in 2002 and 2003, but then declined to 77 percent in 2004. Nevertheless, the BLS share in the smallest change group was larger in every year than the CMS share. So while there was more overall volatility in the CMS wage index than in the BLS wage index, there was a decline of the volatility in the CMS wage index over the period. The BLS wage index exhibited volatility that was variable over the period, but always less than the CMS index.

4.3.4 Distribution of Average Annual Absolute Percent Changes in Index Values, 2000–2004

The mean of the annual absolute percent changes was calculated for each MSA over the five years 2000 to 2004. That is, for each MSA, five annual percent changes were calculated, expressed as absolute values, and then averaged. The results were then grouped into the ranges shown in ***Table 15***, where the frequency of each range is shown. No MSA had an average annual change of 10 percent or more across the five years. About 5 percent of the MSAs had an average annual change in the CMS wage index between 5 and 10 percent while less than 2 percent of the MSAs had an average change in the BLS wage index in the same range. Two–thirds of MSAs had an average change in the CMS wage index of between 0 and 2.49% while nearly 85 percent of MSAs had an average change in the BLS wage index of that amount. The average annual change across all MSAs was 2.3 percent for the CMS index versus 1.7 percent for the BLS index. On this measure, then, although the average change is modest for both indexes, the CMS index was one–third more volatile than the BLS index ((2.3–1.7))/1.7 = 0.35).

4.3.5 Distribution of Standard Deviations of Wage Index Values, 2000–2004

Another measure of volatility of the indexes is the standard deviation of the index values for each MSA over the period 1999 to 2004. ***Tables 16 and 17*** present the distributions of the standard deviations for the CMS and BLS index values respectively; histograms of these distributions are also presented. Tables 16 and 17 are consistent with the previous percent change tables in suggesting that the variability of the BLS index is somewhat smaller than that of the CMS index. The mean and median values of the MSA standard deviations of the BLS index are roughly three–quarters of the corresponding values of the CMS index; a comparison of the histograms shows that the modal BLS value is lower as well.

4.4 Sources of Wage Index Volatility and Data Quality Issues

This section discusses possible sources of volatility in the CMS and BLS wage indexes in Sections 4.4.1 and 4.4.2, and computational and data quality issues in the BLS data in Section 4.4.3. It includes a comparison of the volatility of CMS indexes of wages, benefits, and total compensation in Section 4.4.2. Section 4.4.4 concludes with some remarks on the usefulness of volatility as a measure of data quality.

Table 15
Distribution of Mean Annual Absolute Percent Change in Wage Indexes, for MSAs with BLS RN Wage Data, 2000–2004

Annual Mean Change*	CMS Index		BLS Index	
	Count	Percent	Count	Percent
10% or more	0	0.0	0	0.0
5% to 9.99%	13	5.2	5	1.9
2.5% to 4.99%	70	27.9	36	13.6
0% to 2.49%	168	66.9	223	84.5
Mean across all MSAs	2.3%		1.7%	
Number of MSAs	251	100.0	264	100.0

* For each MSA, average of annual absolute percent changes for each of the 5 years 2000 to 2004.

NOTE: CMS values from published IPPS area wage indexes (see text).

SOURCE: RTI analysis of CMS Wage History File through Fiscal Year 2004 and BLS Occupational Employment Statistics data.

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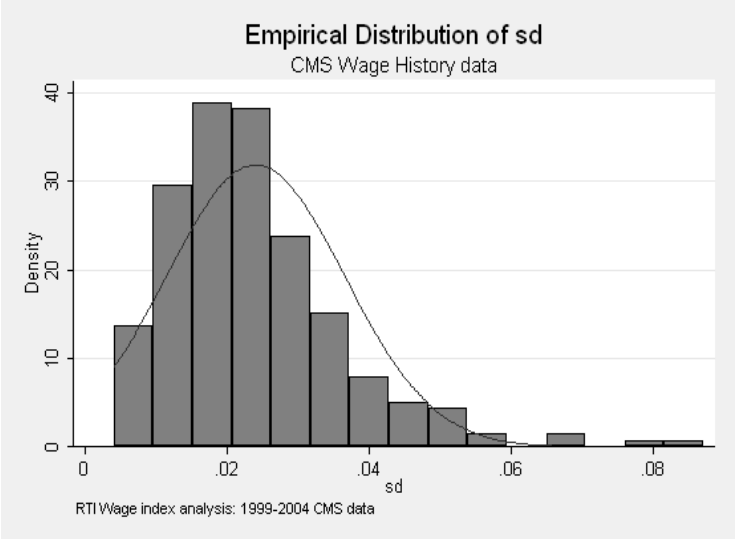
Table 16
Distribution of the Standard Deviation of CMS' IPPS Wage Index for MSAs with BLS RN Wage Data, 1999–2004

Quantile	Standard Deviation
100% (maximum)	0.087
99%	0.069
95%	0.048
90%	0.040
75%	0.029
50% (median)	0.022
25%	0.015
10%	0.011
5%	0.008
1%	0.005
0% (minimum)	0.004
Mean–unweighted	0.024
Number of MSAs	251



NOTE: Published IPPS area wage indexes (see text).

SOURCE: RTI analysis of CMS Wage Index History file through Federal Fiscal Year 2004.

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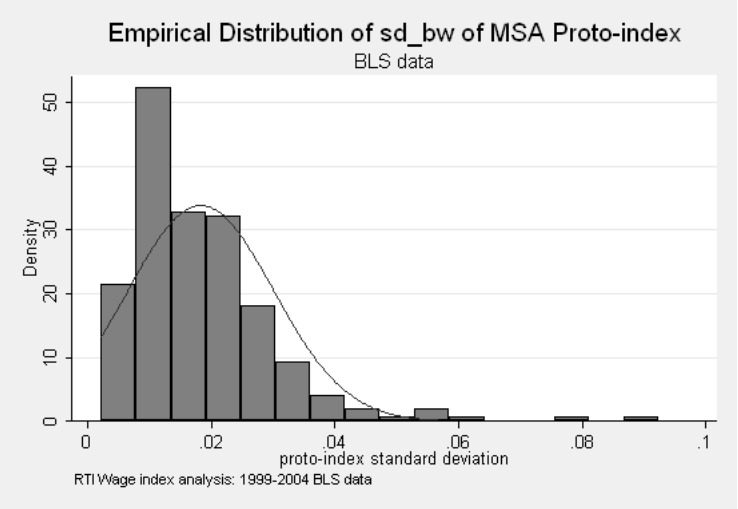
Table 17
Distribution of the Standard Deviation of the BLS Wage Index for MSAs with RN Wage Data, 1999–2004

Quantile	Standard Deviation
100% (maximum)	0.092
99%	0.064
95%	0.039
90%	0.032
75%	0.022
50% (median)	0.016
25%	0.011
10%	0.007
5%	0.005
1%	0.004
0% (minimum)	0.002
Mean–unweighted	0.018
Number of MSAs	264



SOURCE: RTI analysis of BLS Occupational Employment Statistics data.

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4.4.1 Random Variation and MSA Size

Table 18 presents the MSAs with the largest and smallest standard deviations in the CMS and BLS indexes. If there were a great deal of overlap among these MSAs, that could suggest that both indexes are appropriately measuring true wage volatility, or lack of volatility, in these MSAs. Alternatively, if there is little overlap in the lists of MSAs between the two indexes, that could suggest that random variation plays a larger role than true wage variation in determining wage index volatility, or at least that the two indexes are measuring different wage volatility. Although two MSAs (Odessa TX and Yolo CA) appear on both lists of MSAs with the largest standard deviations, there is no overlap among the MSAs with the smallest standard deviations in the two indexes. Of particular interest is that while Tallahassee FL appears on the list of MSAs with the smallest standard deviations in the BLS index, it appears on the list of MSAs with the largest standard deviations in the CMS index. This suggests that random variation played a significant role in determining volatility in the two data series, or that they are measuring different wage changes.

Table 19 compares the largest and smallest standard deviation MSAs on population, the total number of hospitals, and the number of short term hospitals in the CMS and BLS indexes. The interest here is examining whether the volatility of the index values is a function of MSA characteristics, in particular characteristics related to the size of the MSA or of the hospital sector in the MSA. The mean population of the least volatile MSAs is larger than the mean population of the most volatile MSAs for both indexes. It is not the case, however, that the more volatile MSAs are all smaller in population than less volatile ones: the maximum population in the group of MSAs with the largest standard deviation is larger than the minimum population in the group with the smallest standard deviation, in both indexes. Similarly, the mean number of hospitals is higher among the low standard deviation MSAs than among the high standard deviation MSAs, but the maximums in the high standard deviation MSAs is larger than the minimum among the low standard deviation MSAs. In short, the volatility of wage index values is related to MSA size, but MSA size is not the only factor determining volatility.

4.4.2 Volatility in Wages, Benefits, and Total Compensation from CMS Wage Survey Data

The CMS wage index is composed of both wages and benefits (total compensation), whereas the BLS index is based on wages only. It is possible that the greater volatility of the CMS index could be due to the inclusion of benefits. We tested this hypothesis by constructing geographic (MSA) indexes of wages only, benefits only, and total compensation from the CMS hospital wage survey data. ***Table 20*** shows the percentile distribution of annual percent changes in the three indexes from 2000 to 2004 (all years pooled). The volatility (change over time) of the benefits index is much greater than the volatility of the wage index. However, the volatility of the total compensation index (wages plus benefits) is similar to the volatility of the wages only index. We conclude that the inclusion of benefits in the CMS wage index does not explain why the CMS wage index is more volatile than the BLS wage index (which does not include benefits). We discuss and evaluate the benefits data collected as part of the CMS survey further below, in Section 4.5.

Table 18
Ten MSAs with Largest and Smallest Wage Index Standard Deviations, 1999–2004

CMS Wage Index			BLS Wage Index		
MSA Code	MSA Name	Standard Deviation	MSA Code	MSA Name	Standard Deviation
	MSAs with Largest Standard Deviations				
0600	Augusta–Aiken, GA–SC	0.0497	8240	Tallahassee, FL MSA	0.0417
5800	Odessa–Midland, TX	0.0499	1580	Cheyenne, WY MSA	0.0433
4600	Lubbock, TX	0.0505	5800	Odessa–Midland, TX MSA	0.0439
8720	Vallejo–Farifield–Napa, CA	0.0522	9270	Yolo, CA PMSA	0.0497
9270	Yolo, CA	0.0561	4880	McAllen–Edinburg–Mission, TX MSA	0.0530
2281	Dutchess County, NY	0.0563	7485	Santa Cruz–Watsonville, CA PMSA	0.0555
1400	Champaign–Urbana, IL	0.0668	4080	Laredo, TX MSA	0.0578
1240	Brownsville–Harlingen–San Benit	0.0692	1900	Cumberland, MD–WV MSA	0.0639
3740	Kankakee, IL	0.0770	8735	Ventura, CA PMSA	0.0762
5280	Muncie, IN	0.0870	6320	Pittsfield, MA MSA	0.0925
	MSAs with Smallest Standard Deviations				
8680	Utica–Rome, NY	0.0040	7040	St. Louis, MO–IL MSA	0.0022
2335	Elmira, NY	0.0041	1520	Charlotte–Gastonia–Rock Hill, NC–SC MSA	0.0034
3610	Jamestown, NY	0.0049	3720	Kalamazoo–Battle Creek, MI MSA	0.0035
5120	Minneapolis–St. Paul, MN–WI	0.0061	4760	Manchester, NH PMSA	0.0036
8240	Tallahassee, FL	0.0072	3280	Hartford, CT MSA	0.0037
6080	Pensacola, FL	0.0072	6760	Richmond–Petersburg, VA MSA	0.0042
2020	Daytona Beach, FL	0.0072	7600	Seattle–Bellevue–Everett, WA PMSA	0.0043
9260	Yakima, WA	0.0074	5190	Monmouth–Ocean, NJ PMSA	0.0045
1640	Cincinnati, OH–KY–IN	0.0075	1720	Colorado Springs, CO MSA	0.0045
0520	Atlanta, GA	0.0077	4520	Louisville, KY–IN MSA	0.0046

SOURCE: RTI analysis of CMS Wage Index History file and BLS Occupational Employment Statistics data.

COMPUTER OUTPUT: kd_medpac3_fama_march07.log

Table 19
Characteristics of Ten MSAs with Largest and Smallest Wage Index Standard Deviations, 1999–2004

Characteristic	MSAs with Smallest SD			MSAs with Largest SD		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
	CMS Wage Index					
Population estimate 2004	758,473	89,984	3,116,206	255,564	107,188	545,309
Population estimate 2003	750,769	90,413	3,083,637	253,626	105,625	543,943
Population estimate 2002	745,202	90,614	3,054,637	250,786	104,657	541,340
Population estimate 2001	737,175	90,675	3,015,573	246,672	104,122	532,091
Population estimate 1999	708,971	91,738	2,872,109	235,358	102,720	506,685
Total number hospitals 2003	10.9	3	37	4.7	1	11
Total number hospitals 2002	10.9	3	37	4.8	1	11
Total number hospitals 2001	10.8	3	37	4.7	1	11
Total number hospitals 2000	10.7	3	36	4.8	1	11
Total number hospitals 1999	10.9	3	36	4.8	1	11
# short term general hosps 2003	8.6	2	28	3.3	1	7
# short term general hosps 2002	8.6	2	28	3.4	1	7
# short term general hosps 2001	8.6	2	28	3.3	1	7
# short term general hosps 2000	8.3	2	26	3.3	1	7
# short term general hosps 1999	8.7	2	27	3.6	1	8
	BLS Wage Index					
Population estimate 2004	1,397,527	458,332	2,667,862	314,614	85,296	797,699
Population estimate 2003	1,381,905	459,174	2,639,978	309,871	84,083	791,130
Population estimate 2002	1,372,099	457,081	2,633,925	306,013	82,894	783,920
Population estimate 2001	1,354,734	453,455	2,617,637	299,666	81,958	770,630
Population estimate 1999	1,300,141	447,164	2,569,029	283,697	78,877	745,063
Total number hospitals 2003	19.6	5	49	4.4	2	8
Total number hospitals 2002	19.5	5	48	4.7	2	10
Total number hospitals 2001	19.0	5	48	4.7	2	10
Total number hospitals 2000	19.5	5	47	4.7	2	10
Total number hospitals 1999	20.1	5	49	4.8	2	10
# short term general hosps 2003	14.5	4	37	3.6	2	7
# short term general hosps 2002	14.0	4	35	3.6	2	8
# short term general hosps 2001	14.0	4	37	3.7	2	8
# short term general hosps 2000	14.5	4	36	3.7	2	8
# short term general hosps 1999	14.9	4	38	3.7	2	8

SOURCE: RTI analysis of CMS Wage Index History file, BLS Occupational Employment Statistics data, and Area Resource file.

COMPUTER OUTPUT: kd_medpac3_fama_march07.log

Table 20
Distribution of annual percent changes in indexes of hospital wages, benefits, and total compensation, 2000–2004

	Wages	Benefits	Total Compensation
	Percent change from prior year		
Maximum	30.7	175.7	24.3
90th	3.5	11.5	4.0
75th	1.6	5.1	1.9
50th	0.1	0.3	0.1
25th	–1.3	–4.0	–1.5
10th percentile	–2.9	–8.8	–3.4
Minimum	–27.1	–66.6	–25.8

NOTE: Includes PPS wages, benefits, and total compensation.

SOURCE: RTI Analysis of FY 1999 through FY 2004 CMS Hospital Wage Survey File.

4.4.3 Computational and Data Quality Issues in the BLS Series

1) Effect of Rolling Sample

There are two primary issues associated with the rolling nature of the BLS process of sampling employers from which to collect wages (see Section 4.2.1 for description of the BLS sampling and data collection procedures). First, this structure results in year to year samples that are not independent: year to year, two–thirds of the data are unchanged (ignoring the updating, about which see below). As a result, changes in relative wages in an MSA are smoothed, which will tend to reduce the perceived volatility of the data series. Second, because of inflation, data from previous years used in a given year must be updated into current dollars. The Employment Cost Index (ECI) is used to do this. The ECI assumes that the occupational composition in a sector is relatively constant, and that local wages in an occupational category change at the same rate as the national average for that occupational category. This also tends to smooth out the variability in the sample, in that the updating process pulls all MSAs in towards the mean change over time; that is, MSAs experiencing larger than average growth in wage rates are not inflated enough, and MSAs experiencing smaller than average growth in wage rates are inflated too much.

2) Series Consistency[23]

To the extent that specialty hospitals (i.e., those in NAICS categories 622200 and 622300) employ a different occupational mix or offer different wages in a given occupational category than general hospitals (i.e., NAICS 622100), the BLS indexes of all hospitals may not accurately reflect changes in relative wages in general medical and surgical hospitals.

[23] Further details are available at http://www.bls.gov/oes/oes_ques.htm#Ques27.

3) Full Time Versus Part Time Employees

The employment data in the BLS OES series is based on total employment rather than full time equivalents (FTE); the series does not distinguish between full and part time employment. To the extent that there is a difference in hourly wage rates between full and part time employees, and to the extent that some occupational categories are more or less likely to have full time employment in the hospital sector than other sectors, the BLS data series may not yield accurate occupational level mean hourly wages for the hospital sector.

4) Changes in the BLS Series Over Time

BLS instituted a number of changes to the OES series over the period 1999 – 2004 used here. These include:

- In 2002, BLS switched from defining industry sectors under the Standard Industrial Classification (SIC) system to defining them under the North American Industry Classification System (NAICS). This primarily affected how 'auxiliary' establishments are categorized, but also affected the specific jobs listed on the forms (and consequently, employment counts in residual categories).

- When BLS switched to the NAICS in 2002, it did not release data on the 3 digit (e.g., 622000) classification. In order to maximize consistency, the data used here were aggregated from the 4–digit classifications (i.e., 622100, 622200, 622300). The aggregation procedure used here may not be equivalent to the aggregation procedure used by BLS.

- In an attempt to reduce seasonal influences on the data series, in 2002 BLS switched from collecting data in October – December to collecting data at two points during the year, in May and November, and began publishing results twice per year. The May series was used in the analyses here (following MedPAC), and so may introduce some volatility as a result of the 6 – 9 month difference in the seasonal collection pattern.

- Also in 2002, BLS changed the way the occupational mean wage was calculated for categories with highly paid workers (>$70/hr). Note that this occurs if *any* workers in the survey exceeded this threshold, not if the *average* wage exceeded the threshold.

- In 2001, BLS changed the data collection method, specifically regarding employment in categories not listed on the survey forms. This affects residual categories as well as all–sector (e.g., xx–0000) counts.

5) Missing Data

As noted above, wage and employment data were not available at the MSA level for all occupations in all years. Data on RNs (29–1111) were available in all 6 years for 264 out of 318 (83%) MSAs; of these 264 MSAs, only five had complete data in all other categories in all years. The distribution of the data not observed may systematically differ

from the distribution of the data which is observed. For example, it is clear that the more hospitals in an MSA, the more likely that the RN data were reported: 70 of 71 MSAs with more than nine hospitals reported complete RN data, while only 61 out of 149 MSAs with fewer than three hospitals reported complete RN data. To the extent that the number of hospitals in a labor market affects the demand for RN labor, it is plausible that the demand conditions in markets missing the RN data are substantially different than in the MSAs with complete data.

In the absence of outside data, we have to adjust for missing data by making an assumption about the missing wages. Here, we have proportionally normalized the (national) wage bill shares of the occupations with reported wages to equal 100 percent. This assumes that the relative wages (local relative to national) for the missing occupations are equal to the average relative wage of occupations reported for an MSA (weighted by their national wage bill shares). Our normalization for missing data may introduce errors in the MSA–specific index values.

6) Choice of Occupations for Fixed Weight Index

Another question of interest is whether broad aggregate categories (i.e., xx–0000) should be used in the construction of the index. The alternative would be to decompose the xx–0000 categories into the finer classification units (e.g., xx–1234), choosing either the largest categories, or a sufficient number of categories to account for a threshold percentage of employment in the xx–0000 category. The best argument in favor of using the aggregated category would be that the standard error of the estimate would likely be lower than the standard error of the weighted average of the smaller categories; the argument in favor of using the finer categories is that the estimate produced would likely better reflect the occupational mix within the hospital sector. It is an empirical question whether the reduced variance would compensate for the increased bias.

4.4.4 Is Volatility a Useful Gauge for Data Quality?

It should be recognized that not all variability in a wage index is 'bad.' The purpose of a wage index is to recognize real differences in wages across labor market areas, including changes over time in a labor market area's relative wages. Variability due to real changes is desirable; it is variability that does not reflect real changes that should be avoided. Unfortunately, there is no definitive way to distinguish the former from the latter within either the CMS or BLS data series. It may be possible to infer that changes which are consistent across the two series are more likely to be real; or that annual wage changes that are consistent with longer–term trends in area wages are more likely to be real than changes that do not exhibit any trend. But there is no conclusive test for how much of the variation within either wage series reflects real wage changes versus measurement errors. The absence of the definitive ability to distinguish 'good' variability from 'bad' variability limits the usefulness of variability itself as a metric on which to evaluate the performance of the alternative wage indexes.

4.5 Variation in Hospital Benefits Over Time and Geography

Most of our discussion has focused on wages, but benefits comprise a significant and growing share of the total compensation data underlying the current Medicare hospital wage

index. In this section, we first discuss the definition and reporting of the benefits data in the Medicare Cost Reports, in Section 4.5.1. Then we present empirical evidence on trends and geographic variation in hospital benefits as a percentage of total compensation in Section 4.5.2. If benefits were a constant proportion of total compensation across areas, then it would be sufficient to measure wage variation across areas, that is, it would not be necessary to incorporate benefits into the Medicare area wage index adjustment.

4.5.1 CMS Benefits Data

Our CMS total compensation wage series includes both contract labor and benefits, and both of these items are less consistently reported across hospitals than wages. Relative benefits are expected to exhibit more variability – across providers, markets and over time – because they are not as precisely defined as payroll–related wages. "Wage–related costs" as reported on the Worksheet S–3 surveys are intended to capture benefits accumulated in the hospitals' accounting record books in accordance with generally accepted accounting principles (GAAP). These types of costs are expected to include items such as payroll taxes, health insurance, pensions or other retirement contributions, child care benefits, tuition reimbursement or retiree health care costs. The instructions to Worksheet S–3 Part II allow hospitals to record additional wage–related costs that may not have been allowed elsewhere on the MCR, provided they follow GAAP. Although there is an extensive reconciliation worksheet that providers are asked to file to document all of the benefits that they report for wage index purposes (Exhibit 6 of CMS Form 339, the "Provider Cost Report Reimbursement Questionnaire"), there are many grey areas where appropriate measurement may be argued. This is particularly true for capturing current period pension expenses, expenses related to self–funded insurance, and the proper handling of severance pay. For this reason, it would be difficult to establish how much of the market–level variation in relative benefits that we see is due to real variation in this type of compensation, and how much is due to variation in accounting practices. Where we see stable differences in relative benefits between larger markets, this might be more likely to reflect true regional variation in non–wage compensation. In markets with only a few hospitals, total compensation index values are sensitive to individual provider decisions on specific accounting issues.

4.5.2 Variation in Benefits as Percent of Total Hourly Compensation

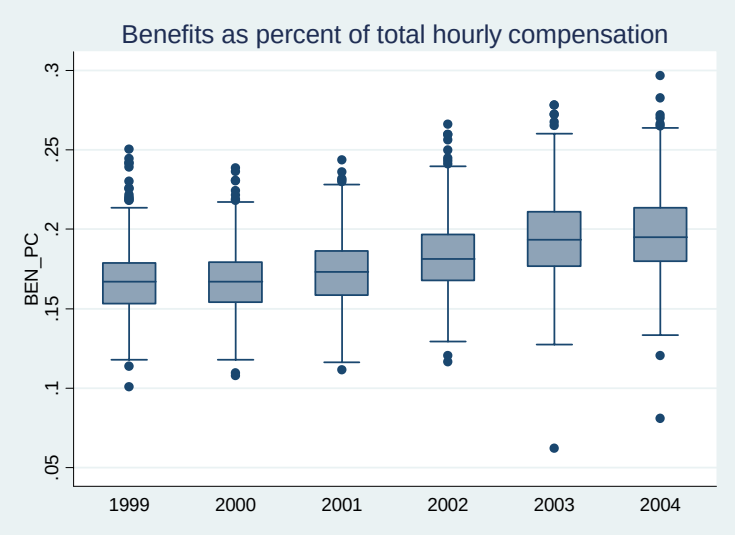
Using the hospital Medicare Cost Report data, there is a clear increase in reported benefits as a percentage of total compensation over the six years of our study, that occurred in both rural and urban areas, and across all regions (***Table 21*** and ***Figure 1***). Across markets, the mean value of benefits as a proportion of total hourly compensation rose from 16.7 percent in 1999 to 19.7 in 2004. The increase was especially rapid from 2000 to 2003. Outlier markets with values below 10 percent occurred in only two years, and very few markets have aggregate benefits greater than 25 percent of total compensation (***Figure 1***). Using FY 2004 data only, there is some regional variation in benefits as a percentage of total compensation—the Northeast and Midwest are above average, the South is below average, and the West is about average (***Table 21*** and ***Figure 2)***. Statistically significant differences are present only between the South and the Northeast, and the South and the Midwest. There are no statistically significant differences in benefits as a percentage of total compensation between urban and rural markets (***Figure 2***).

Table 21
Benefits as Percent of Hospital Total Hourly Compensation, by Year and Location, as Reported on the Medicare Cost Reports (market–level mean values)

Urban markets	Northeast	Midwest	South	West	All Areas
1999	17.0%	16.9%	16.5%	16.6%	16.7%
2000	17.0%	16.7%	16.5%	16.9%	16.7%
2001	17.5%	17.5%	16.9%	17.2%	17.2%
2002	18.6%	18.6%	17.8%	18.3%	18.2%
2003	20.0%	20.3%	18.6%	19.3%	19.4%
2004	20.2%	20.6%	18.9%	19.5%	19.6%
Rural markets					
1999	17.9%	16.8%	16.8%	17.2%	17.1%
2000	17.9%	17.2%	16.9%	17.8%	17.3%
2001	18.3%	18.1%	17.4%	18.2%	17.9%
2002	19.4%	19.2%	18.2%	19.2%	18.9%
2003	21.1%	20.5%	18.9%	19.9%	19.9%
2004	21.7%	20.2%	19.2%	20.4%	20.1%

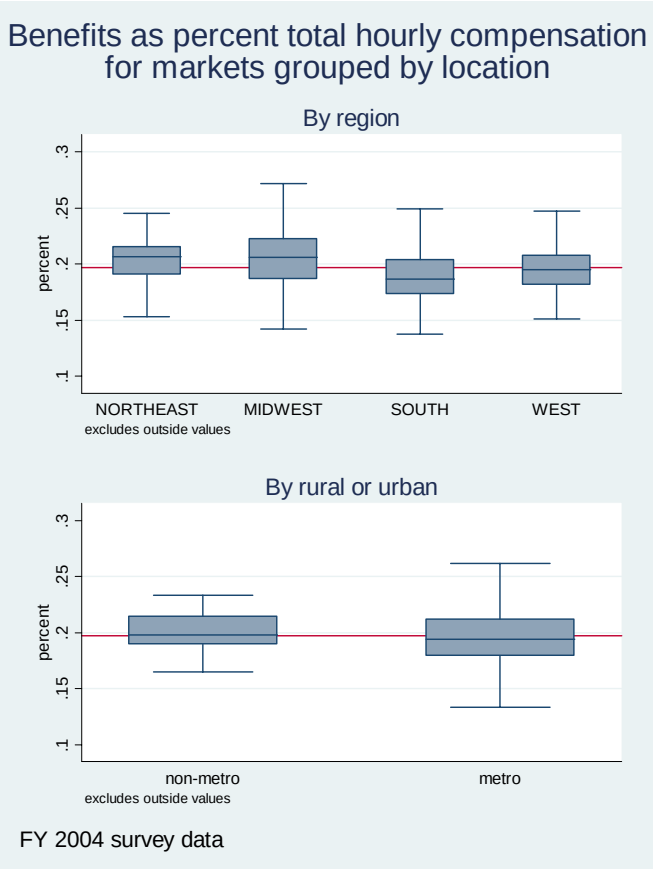
SOURCE: RTI analysis of hospital Medicare Cost Report wage survey data.

Figure 1
Temporal Trends in Benefits as Reported on the Medicare Cost Report Worksheet S–3



SOURCE: RTI analysis of hospital Medicare Cost Report wage survey data.

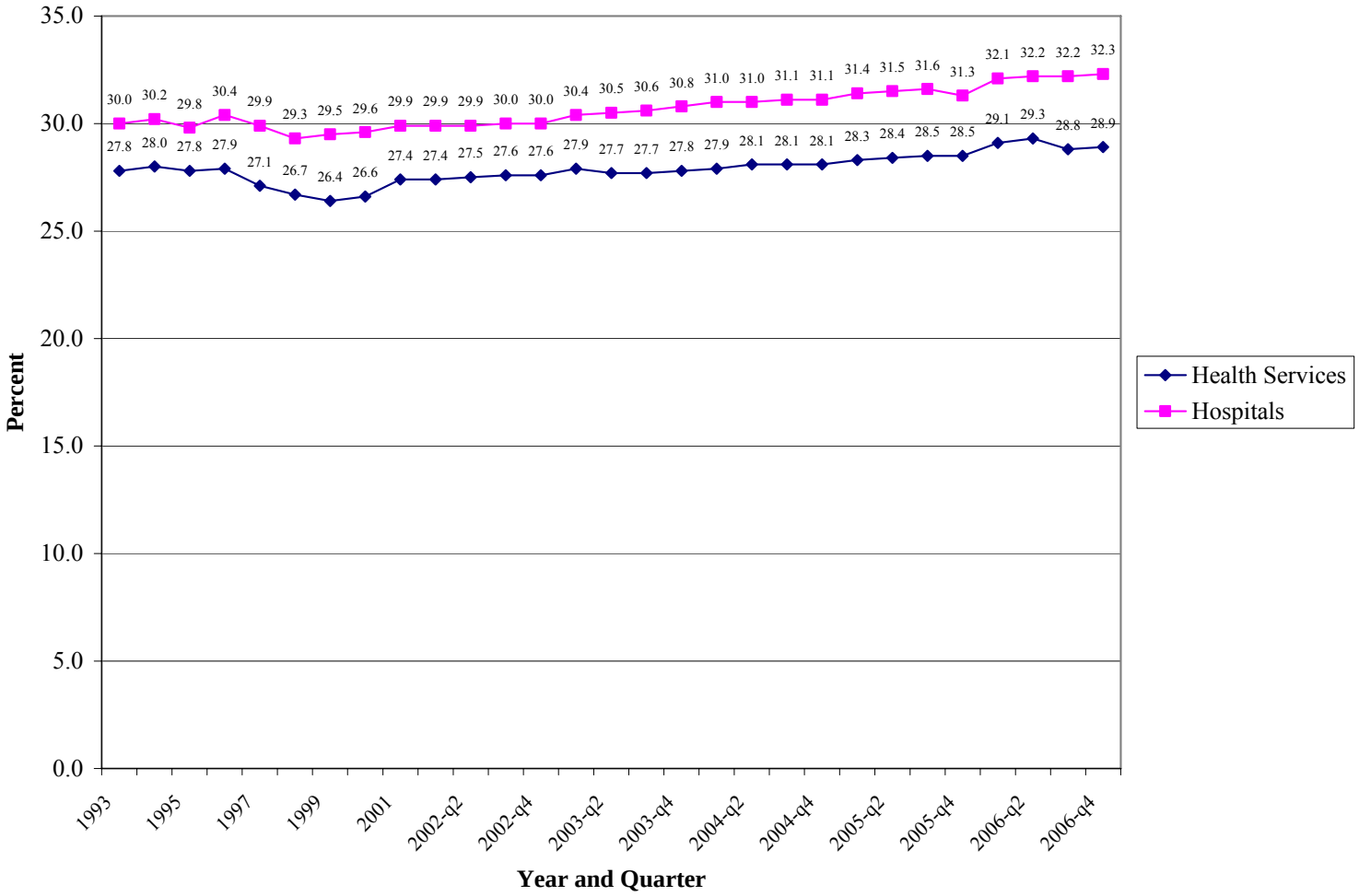
Figure 2
Geographic Variations in Benefits as Reported on the Medicare Cost Report Worksheet S–3 (FY 2004 survey only)



SOURCE: RTI analysis of hospital Medicare Cost Report wage survey data.

The BLS data Employer Cost for Employee Compensation series does not show any trend in benefits as a share of total compensation for all health services workers between 1993 and 2002, but shows an upward trend from 2002 to 2006 (***Figure 3***). For hospital workers, the share of benefits increased slightly by about 1.5 percentage points between 1993 and 2004. It increased again subsequent to 2004 by nearly a full percentage point, possibly due to a surge in health insurance premiums. From 1999 to 2004, the increase in the BLS share of benefits is clearly smaller than the increase in the Medicare Cost Report share of benefits (1.5 percentage points versus 3 percentage points). It is possible that the larger upward trend in the benefit percentage reported on the Medicare Cost Reports arises from the incentive for more complete reporting of benefits because of the use of these data in the Medicare hospital wage index adjustment. It appears that the BLS is including more benefits in its series than CMS is, because the BLS benefit percentage is about 30 percent, compared to less than 20 percent for the CMS series. Hence, the benefit trends in these two data series may not be directly comparable.

Figure 3
Benefits as a Share of Total Compensation, 1993–2006, According to BLS Health Services and Hospital Occupations, National

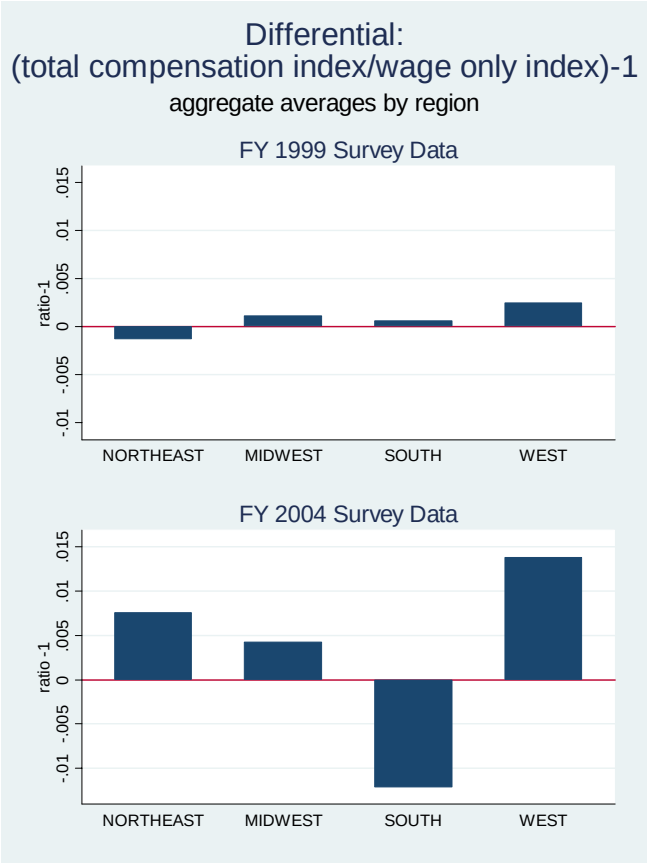


NOTE: Civilian workers.

SOURCE: RTI analysis of BLS Employer Cost for Employee Compensation data.

If reported Medicare Cost Report benefits are accurate, the differences in more recent years between markets in the South and markets elsewhere in the country raise the potential that any index constructed without data on benefits will overstate relative total compensation costs in the South. We computed the ratio of the total compensation index to the wage–only index (minus 1) as a measure of potential bias. If relative total compensation is higher than relative wages in an area, this measure will be positive. The bar graphs in ***Figure 4*** show unweighted mean values of this measure across all markets, grouped by region. In 1999 there would been have been little regional bias from excluding benefits in the computation, but by 2004, relative total compensation in the South is systematically lower than relative wages and relative total compensation in other regions, particularly the West, is systematically higher than relative wages. Hence, excluding benefits from the hospital wage index calculation would benefit the South and disadvantage other regions, particularly the West.

Figure 4
Potential Regional Bias from Excluding Benefits in the Wage Index Computations



SOURCE: RTI analysis of hospital Medicare Cost Report wage survey data.

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