A CRITIQUE OF RECENT PUBLICATIONS ON PROVIDER MARKET POWER

October 4, 2010

Margaret E. Guerin-Calvert

Vice Chairman and Senior Managing Director

Guillermo Israilevich

Vice President

Compass Lexecon

1101 K Street NW, 8th Floor
Washington, DC 20005
Phone: 202.589.3450

A CRITIQUE OF RECENT PUBLICATIONS ON PROVIDER MARKET POWER[1]

I. Introduction and Summary

A. Overview

Numerous studies have examined trends in healthcare costs and differences in costs or prices among hospitals or regions in the U.S. with varied purposes: *e.g.*, identifying areas or facilities with lower or reduced costs, assessing key cost drivers (*e.g.*, inputs, utilization, mix of patients, prices), examining the market conditions or other factors that result in lower costs/prices and higher quality, or estimating current versus future predicted healthcare expenditures. While many of these studies involve extensive empirical analyses and databases, including time series or cross-sectional analyses, others are either more qualitative or case-specific, if not anecdotal. The co-authors at Compass Lexecon were commissioned by the American Hospital Association ("AHA") to evaluate two of these publications – the 2010 Report by the Massachusetts AG on Health Care Costs and the 2010 article in *Health Affairs* about California health care providers.[2] The widely publicized claims of these two publications are that negotiated commercial rates for healthcare services at *large* provider organizations are substantially higher than those for other organizations, and that observed differences are due predominantly to market power/leverage associated with size. These publications, however, either do not explore whether factors commonly thought to explain differences in the costs of delivering care are relevant explanatory factors in Massachusetts or California or conclude based on very limited analyses that they are not. These factors include key variables such as case mix, extensive internship and residency programs, scope of services or medical staff, demographics and health status of patient population served, or payor mix. Moreover, the publications find few if any offsetting quality or efficiency benefits. Thus, these publications' claims imply hostility towards and potential challenges to additional consolidation, integration, or coordination among provider organizations, including the formation of Accountable Care Organizations, with their attendant increase in organizational size.

This Critique presents the analyses conducted to (1) evaluate the Massachusetts AG Report and the Article, and (2) assess the findings of these publications and the policy conclusions drawn

---

[1] This Critique benefited substantially from the assistance of Jeffrey Raileanu and Matthew Schmitt of Compass Lexecon. This Critique made use of healthcare literature, data from the Centers for Medicare & Medicaid Services ("CMS"), data from the Massachusetts Division of Health Care Finance & Policy ("DHCFP"), and AHA data. The views and opinions presented are solely those of the authors and do not necessarily reflect the views of organizations with whom the authors are or have been affiliated. The co-authors have worked on a number of healthcare matters for a variety of healthcare entities, including providers, health plans, government, and associations. A summary of the healthcare experience is available at www.compasslexecon.com.

[2] Office of Attorney General Martha Coakley, "Examination of Health Care Cost Trends and Cost Drivers," March 16 2010, and O'Brien, Thomas M., Office of Attorney General Martha Coakley, Letter to Brent Henry at Partners HealthCare System, Inc., June 25 2010, (*hereinafter* "Report" or "AG Report"); Berenson, Robert A., Paul B. Ginsburg, and Nicole Kemper, "Unchecked Provider Clout in California Foreshadows Challenges to Health Reform," *Health Affairs*, Vol. 29, No. 4, April 2010 (*hereinafter* "Article").

from them. In particular, this Critique focuses on the claims that hospital "leverage" or market power is the predominant explanatory factor for differences in "prices" and increased hospital expenditures.

B. The Massachusetts AG Report and the Article on California Providers

The Massachusetts AG Report and the Article on California providers approach the issue of price differences and alleged market power in somewhat different ways:[3]

The Article presents a number of anecdotal observations based on interviews with many market participants in several California regions, supplemented with some discussion of historical trends such as changes from HMO to PPO enrollment, consolidation of hospitals, and financial implications of shifts from HMO to PPO contracting for providers.

The Massachusetts AG Report is focused on an examination of *differences* in payments made to hospitals by commercial insurers at a point in time. Thus, the approach is a cross-sectional one based on data and information collected from and about insurers and providers, and measures that the Report develops such as its derived measure of market power or "leverage." The AG Report presents a series of analyses that relate payments at a point in time to specific factors and reaches its conclusions based on its interpretations of these "single variable" or univariate relationships. Our evaluation of the AG Report focuses primarily on an assessment of its empirical analyses, including re-evaluation of its analyses, review of alternative explanations for its findings, and putting its conclusions into the context of an extensive literature on payment and spending differences.

As is detailed in the summary section that follows, the conclusions reached in each publication are not supported by the publication itself and are further refuted by examination of the numerous factors that drive costs and payments.

C. Summary of Economic Evaluation of the Article on California Providers and the Massachusetts AG Report

<u>Article on California Providers</u>

The Article reaches its conclusions through interviews and observations about trends in healthcare in California, including the change from narrower HMO networks to broader PPO networks. The Article claims that:

- The Article observes a differential between Medicare rates and the negotiated rates for commercial insurers nationally, and couples this observation with references to a period of mergers and consolidation in California. The implied linkage made by the Article is that the Medicare-commercial differential is driven by hospital mergers and consolidation;

[3] When we use the term "market power," we are referring to the anticompetitive exercise of market power. Market power can be, and often is, used and defined in different ways. The appropriate standard for the context in which these studies are using the term should be market power exercised in an anticompetitive fashion that reduces consumer welfare, and these studies do not establish that.

- Certain trends reflect increased provider bargaining or market power that has translated into above-competitive pricing: (1) an increase in commercial payment rates to providers from 1999-2005, in contrast to the payment declines observed in the 1990s; (2) the evolution of health plan product offerings toward broader networks in response to consumer demand; (3) the characterization of some hospitals as "must-have" hospitals; and (4) the impact of contracting on hospital finances and excess capacity and the resulting exit and consolidation of hospitals.

The Article uses the term "market power" very loosely to encompass a wide variety of conditions and circumstances, including many that are not traditionally treated as anticompetitive. Moreover, the Article confounds many different factors that are occurring over the period that account for changes in payments, and mistakes changes in consumer demand for market power. We examined each of the claims and the basis on which they were made, and conclude that they are not supported by any empirical analyses or placed in market context, and fail to account for alternative, market-based explanations for the observed price trends and differences. Based on an independent evaluation of the Article, we reach the following three conclusions:

First, anecdotal observations on prices at individual hospitals do not provide a systematic basis on which to evaluate or discern market power. Hospitals are mistakenly identified as exercising anticompetitive market power without any evaluation of any market conditions in the regions studied. The Article provides no empirical evidence for the proposition that the observed trends in payment rates for California hospitals, either generally or related to Medicare rates, are empirically linked to market power or hospital consolidation in California as opposed to cost trends and other factors. In fact, cost increases are an important factor experienced by hospitals in California and nationwide, with some pressures unique to California such as compliance with seismic requirements.

The Article further compounds the errors with regard to market power and size by assuming that any increased costs accompanying the change in consumer demand for HMOs to PPOs in California should be attributable to provider market power. There is no analysis of competitive mechanisms to discipline pricing in a PPO environment or the market context in which contracting is done; the statements in the Article imply that hospitals have market power both where market conditions are competitive and where they are not.

Second, the Article fails to analyze any of a myriad of factors that could explain differences in prices and costs among hospitals, including those examined in depth in many studies of healthcare costs and expenditures.

Third, the Article confuses consumer preference for certain providers, highly differentiated services, or specialized services with anticompetitive market power. The Article fails to acknowledge that many hospitals with high-level services, such as those offered at the tertiary care hospitals given as examples in the Article, have higher costs than hospitals that do not provide such services, and that such higher costs imply higher prices. Moreover, the Article does not examine the competitive constraints facing hospitals for some or all of their services, and equates the desirability of hospitals and inclusion in networks as evidence of market power (and the ability to negotiate prices above competitive levels). A hospital can become a highly desired

hospital simply by providing excellent services, whether or not it has market power. Indeed, strong consumer preferences for specific hospitals and their services provide an incentive for hospitals to improve services, enhance quality, or expand output of services in great demand, and to expect an appropriate return on the investments required to provide these services.

The AG Report

The AG Report reaches its conclusions about the apparent sources of variation in expenditures for hospital services in Massachusetts via a series of simple univariate correlations, the results of which are largely unreported:

> Price variations are not correlated to (1) quality of care, (2) the sickness of the population served or complexity of the services provided, (3) the extent to which a provider cares for a large portion of patients on Medicare or Medicaid, or (4) whether a provider is an academic teaching or research facility.[4] (*Emphasis in original.*)

Instead, the report concludes that "leverage" and price are correlated and that "leverage" explains differences in prices.

The conviction with which these conclusions are reported is immediately undermined by the absence of any reported correlation analyses or statistics in the document. Moreover, the Report's bar chart graphics depicting payment measures[5] per hospital and the various measures tested (*e.g.*, Case Mix Index ("CMI")) provide visual contradiction of these conclusions. Furthermore, conclusions that prices are not correlated to teaching status, the complexity of the treatment, or the sickness of the population are in sharp contrast with a large body of empirical research that relates health care expenditures or payments to these variables, among others. The AG findings—*if correct, which they are not*—would imply that hospital costs and reimbursement rates are not affected by the services offered or the patient population actually served by a hospital.[6]

While the AG Report does not report its underlying data or the statistical results of its data analyses, its empirical analyses can be tested by: (1) extracting the price and other measures directly from the Report's graphics and re-running the analyses; (2) using "price" measures for the hospitals studied in the AG Report that are available from other sources (*e.g.*, Medicare Cost Reports data) and re-running the analyses; and (3) evaluating the methodology, economic logic, and data employed in the Report.

---

[4] AG Report, p. 3. We recognize here that others have provided review and comments on the AG Report; *see e.g.*, Letter to the Honorable Martha Coakley, Attorney General, State of Massachusetts, from Melinda Reid Hatton, Senior Vice President and General Counsel, American Hospital Association, April 29 2010, and Dreyer, Paul, "Analysis of the Attorney General's Report Titled 'Examination of Health Care Cost Trends and Cost Drivers'," June 17 2010.

[5] The AG Report's "price" measure varies and tends to reflect payments made by commercial insurers to hospitals. In this Critique, we also use the term "price" to refer to payment measures as well as revenue measures such as average revenue per discharge.

[6] The AG Report appears to recognize the influence of these factors since it went to some length to adjust prices by case mix (*see* General Appendix, pp. 2-4).

Based on these three approaches and analyses of other factors, we reached the following four conclusions about the AG Report:

First, ignoring its methodological limitations and any flaws in data development, we have used the data as shown in the Report's charts to estimate and report correlations. Contrary to the AG Report's assertions, we found that several of the reported variables <u>are</u> correlated with prices. The AG's own data reveal correlations and do not support the Report's conclusions.

Second, the asserted conclusions are undermined even further by the lack of sound economic foundation for the use of simple cross-sectional univariate correlations of "price" and other measures as a means to evaluate the sources of <u>cost increases</u> over time. Sound economic modeling and evaluation of trends over time reject the conclusions reached in the AG Report and highlight the numerous factors that account for differences:

- While the AG Report states "price variations are not adequately explained by differences in hospital costs of delivering similar services at similar facilities," (1) the Report does not provide a methodology to assess whether prices are explained by costs and conducts no analyses of cost trends over time; (2) the Report does not analyze the empirical relationship between costs and prices; (3) the Report analyzes costs at only six hospitals and extrapolates its unsupported conclusions to all hospitals; (4) the Report adjusts costs by CMI and *incorrectly* assumes that this adjustment will account for any differences in complexity, severity of illness, and quality; and (5) the Report ignores that exogenous cost factors may increase prices, even if these costs are not related to quality.
- Examination of cost trends over time, including labor and non-labor expenses, show that Massachusetts hospitals and hospitals across the country have experienced substantial increases in costs over the period examined in the AG Report. These factors are essentially unaccounted for in the AG Report.
- Cross-sectional analyses can inform sources of differences, but the cross-sectional analyses presented in the AG Report are not a substitute for time series analyses in seeking information about sources of changes in costs or price.
- The AG Report is primarily based on univariate correlation analyses. Review of other studies that examine sources of differences among regions or hospitals show that they (1) tend to be based on multivariate analyses with substantial effort to establish an underlying model of causal factors,[7] (2) include a number of the factors that are not examined in the AG studies, (3) find substantial empirical relationships between these factors as explaining differences, and (4) show greater explanatory power as the models are more refined and more inclusive of complex supply and demand relationships.

Third, the AG Report uses provider size as a proxy for market power and mistakenly concludes that observed relationships between size and price reflect anticompetitive market power:

- The AG measure of market power is flawed and does not represent a measure of market power or anticompetitive power as these terms are typically used by the antitrust agencies and recognized by the courts. Although vaguely defined, "leverage" appears to focus on

[7] We note that many of these studies examined differences in expenditures and not just cost or price, and hence account for utilization as well as price.

provider size and is a "non-scientific proxy" of the relative leverage between providers and insurers.

- Size and even market share alone, however, are not indicative of market power in healthcare or in other industries: (1) revenue size or bed size are correlated with factors that are associated with higher costs, including CMI and teaching intensity;[8] and (2) market power claims are made without regard to any market area or geographic analyses, including assessment of the alternatives available. The markets described are not highly concentrated, suggesting that there are numerous alternative hospitals.
- The AG Report does not consider the basic economic principle that investments in technology, staffing, or quality of service merit returns, and that returns are required in order to induce the continued investments. Nor does it consider the costs associated with current payment structures and imbalances between private and government payors in the levels of reimbursements provided by each. Finally, the AG Report seems to equate market power with the size that a hospital may achieve based on competitive behavior such as substantial service offerings, a reputation for services or quality of care and substantial consumer demand for its services.

Finally, the AG Report does not accurately account for the complexity of measures related to quality, and mistakenly concludes there is no relationship or difference in quality related to price.

- The AG Report claims that there is little variation in the quality of care delivered. However, a small variation in the quality perceived by consumers for procedures may result in a wide variation in willingness to pay for hospitals they prefer. The AG report does not provide benchmarks or counterfactuals to assess whether the price dispersion observed is unusual relative to other healthcare regions. The academic literature shows that use of quality measures such as mortality scores (*see* AG Report, pp. 16-17) may lead to a spurious inference about hospital quality.[9]

[8] For example, the AG failure to properly incorporate CMI and teaching intensity as factors in explaining prices may lead to a spurious finding that large hospitals have market power. This is because size is correlated with CMI and teaching intensity (and relative size is basically what drives the AG measure of "leverage").

[9] Some studies have found strong evidence that patients with high unobserved severity of illness tend to be disproportionally admitted to high-quality hospitals and this increases the mortality rates at high quality hospitals. Hospital quality can be identified using more sophisticated econometric methods. For example, Geweke et al. (2003) use the distance traveled by patients as a measure of the severity of illness that allows better adjustment for severity when measuring quality. *See* Geweke, John, Gautam Gowrisankaran, and Robert J. Town, "Bayesian Inference for Hospital Quality in a Selection Model," *Econometrica,* Vol. 71, No. 4 (2003).

II. Economic Evaluation of the Article on California Providers

The Article summarizes and references the results of site interviews conducted by the Center for Studying Health System Change in October-December 2008 in six California metropolitan areas of insurers, physician groups, hospitals, and other market participants.[10] The co-authors also summarize or reference certain papers that examine general trends in payment rates and cost trends, managed care, and consolidation, both nationally and in California. The Article then links together observations about commercial payment rate levels, trends, or differentials from these sources to observations about managed care trends, payment trends, and mergers and consolidation to reach its conclusion that payment differentials and payment levels are driven by provider or health system market power, both generally and in California. The Article uses the term "market power" very loosely to encompass a wide variety of conditions and circumstances, including many that are not traditionally defined as anticompetitive. These include payment differentials for specific hospitals with different service or quality levels, changes in conditions faced by insurers or providers with HMO and PPO contracting, and decreases in hospital capacity.

There are three key claims that are made in the Article:

- The Article observes a differential between Medicare rates and the negotiated payment rates for physician and hospital services by commercial insurers nationally, and couples this observation with references to papers that provide high level summaries of selected hospital merger studies and their effects on quality and cost. The implied linkage made by the Article is that the Medicare-commercial differential is driven by hospital mergers and consolidation.
- The Article next observes that trends in commercial payments to providers in California increased in the 1999-2005 period as contrasted with a general decline in rates in the 1990s. The Article compares the annual percentage increase in payments for commercial insurance in California to estimates of inpatient cost per admission based on Medicare Cost Report data for the nation for the same period. The Article provides a summary of managed care trends in California, including the evolution from indemnity to HMO, from HMO to PPO and broader networks in response to consumer demand, the continued role of Kaiser, and the impact of contracting on hospital finances and excess capacity and resulting exit and consolidation. The Article then infers that consolidation and increased bargaining or market power are driving relative price trends.
- The Article provides anecdotes of differences in prices for services at specific California hospitals and references studies that observe that some California hospitals have prices that are higher than "average."[11] The Article asserts without any empirical support that the observed differences are due to market power.

[10] The site interviews were conducted in Fresno, Los Angeles, Oakland/San Francisco, Riverside/San Bernardino, Sacramento, and San Diego.

[11] The Article incorrectly refers to "large variations in hospital rates across the country," listing specific hospitals that it asserts has established "prices far above average." *See* p. 2 (*emphasis added*). The source cited for these facts is Milliman, Inc.'s report, "Cost Efficiency at Hospital Facilities in California: a Report Based on Publicly Available Data," (October 2007) ("Milliman Report"). However, the Milliman Report is only limited to California; it does not show "rates across the country." In addition, the Article fails to mention that there are also hospitals in the same systems as those listed with prices *below average*

Scrutiny of each of these three claims and evaluation of data and information, including those referenced in the Article, shows that the asserted linkages between payments and market power are not supported. Instead, many other factors account for the observed differences. Each of the three claims is evaluated in turn.

Differentials between commercial and Medicare payments do not support a market power conclusion.

By juxtaposing observations about commercial and Medicare payments with providers and hospital mergers and consolidation, the Article asserts a linkage between such differentials and hospital mergers and market power.[12] However, observed differences between payment levels for private insurance and Medicare are well documented and due to factors other than mergers and consolidation or the fact that commercial insurers negotiate payment rates with hospitals and other providers. In particular, studies conducted by or on behalf of insurers and providers, as well as numerous independent studies, demonstrate that trends in relative payment rates are driven largely by government reimbursements not having kept pace with costs. Relatively higher reimbursements from commercial payors due to below-cost reimbursements from government payors is a nationwide phenomenon that cuts across a spectrum of providers and market conditions.[13] The Article provides no economic support for the conclusion that the observed differentials are driven by hospitals' exercise of market power through consolidation of operations.

Numerous other factors are also related to differences in prices and to changes in payments or expenditure. As is detailed in the following sections, these include a variety of market, patient, and hospital-specific factors, including wage and other costs, health status, the patient population served, teaching and research programs at hospitals, and numerous other factors.

Trends in managed care contracting, consumer demand, and hospital closure and consolidation in California do not support a monopoly/market power conclusion.

The Article appears to equate trends in payment rates in California between 1999 and 2005 with market power due either to merger/consolidation or changes in the relative bargaining position of payors and providers. The Article, however, confounds many different factors that are occurring over the same period that could individually or collectively account for changes in payments. In addition, the Article mistakes changes in consumer demand for market power:

---

for California (*see* Milliman Report, Attachment G-1). Finally, the Milliman Report calculates price and cost indices by hospital and notes that these numbers only adjust for a measure of severity (APR-DRG/SOI) and Medicare cost indexes. In particular, the Milliman Report notes that it does not adjust for charity care, Medicaid (Medi-Cal), and teaching intensity.

[12] The Article, p. 1.

[13] For example, a study conducted by Milliman Inc. and commissioned by America's Health Insurance Plans, the American Hospital Association, the Blue Cross Blue Shield Association, and Premera Blue Cross attempts to quantify the magnitude of the costs paid by commercial payors as reimbursements by Medicare and Medicaid have not kept up with costs. *See* Will Fox and John Pickering, "Hospital & Physician Cost Shift: Payment Level Comparison of Medicare, Medicaid, and Commercial Payers," December 2008. *See also* Allen Dobson, Joan DaVanzo and Namrata Sen, "The Cost-Shift Payment 'Hydraulic': Foundation, History, And Implications," *Health Affairs*, Vol. 25, No. 1 (2006). Trendlines in payments from Medicare and Medicaid relative to third party payors are provided in the AHA Chartbook, Chapter 4, "Trends in Hospital Financing" (2010).

- The Article does not recognize that negotiated reimbursement levels tend to increase with increases in underlying costs of care. It mentions briefly, but does not evaluate underlying cost conditions and trends that affected hospitals and providers in California during the 1999-2005 period, including labor and non-labor costs, or increased capital and other costs required for compliance with seismic requirements. As detailed elsewhere in this Critique, hospital expenses nationwide increased substantially during this period with non-physician labor and patient-care costs generally accounting for a substantial proportion of hospital expenses and of total cost increases.
- The Article does not assess competitive market conditions in the six regions studied or market conditions in California generally. It simply draws conclusions about market power without a thorough analysis of market concentration or other factors commonly considered when evaluating whether firms have market power.
- Similarly, the Article asserts that acquisitions of hospitals by larger health systems in California and the formation of larger networks have enabled these systems and networks to negotiate higher rates.[14] There is no empirical evidence cited for this proposition, nor does the Article reference the large body of studies that document the recent increases in provider costs and other explanatory factors. As is detailed further in Section V, empirical evidence on labor and non-labor costs reveal that hospitals nationwide have experienced increases in costs. Furthermore, there is an extensive literature detailed in the following section that examines numerous factors including demographics, health status, provider and payor characteristics, teaching status, CMI, other measures of severity of care, and underlying cost factors such as labor and supply costs, and relates these factors to changes in prices or spending.
- Trends in reimbursements with the movement from indemnity to HMO, and then from HMO to PPO, are equated at least in part with alleged market power. However, these trends have been observed nationwide. Changes after the late 1990s are due to a number of factors, including cost increases, trends in Medicare and Medicaid reimbursements, and efforts to adjust pricing based on the initial experience with managed care contracting.[15]
- More specifically, the Article appears to equate changes in consumer demand for broader networks, and the resulting changes in network configurations, with provider market power. This seems to reflect either a misuse or a very broad interpretation of the term market power: Just because many if not all providers are "in-network" for a given insurer does not imply that insurers lack mechanisms to achieve competitive rates with providers or that providers obtain anticompetitive market power as markets evolve from HMO to PPO structures. In fact, these changes in consumer demand can occur both in competitive markets and markets with a less competitive structure.
- The Article observes that there has been a reduction in hospital capacity, and appears to relate this observation to changes in reimbursement. As noted in the Article, some of the consolidation and exit was due to lower payment rates and the resulting financial circumstances of hospitals that were unable to invest in needed capacity or meet enhanced seismic requirements. These factors support, rather than reject, an alternative

[14] The Article, p. 4.

[15] The Article does note some of these factors, including the fact that many hospitals in California experienced substantial financial difficulties with initial HMO contracting. *See* the Article, p. 4.

explanation for cost pressures and higher reimbursement in California. Finally, while the Article appears to assert that reduced inpatient capacity may have resulted in shortages in California,[16] there is no reference to other trends, such as expanded utilization of outpatient facilities. Even where there are shortages, the resulting prices are not evidence of market power but market signals that attract resources.

The Article confuses consumer preference for higher quality providers or the presence of specialized services with market power.

The Article presents a discussion of the concept of "must-have" hospitals that equates the existence of specific attributes such as specialized services with the ability of hospitals to negotiate anticompetitively high prices for some or all of their services.[17] The "must-have" concept employed in the Article, however, confounds a number of factors that explain observed differences and, in particular, confuses hospital attributes with anticompetitive market power. The Article does not have a clear measure of market power or leverage, and refers predominantly to the concept of "must-have" hospitals, or hospitals with specialized services.

- First, the Article fails to address that many hospitals with the types of services such as those offered at a large, tertiary care hospital in Los Angeles given as an example in the Article, tend to have higher costs than hospitals that do not provide such services. Teaching status, size of residency program, and CMI are related to differences in reimbursements (both for Medicare and for non-Medicare) among hospitals. Thus, payment differentials are an expected result based on the costs and services offered.[18]
- Second, the Article does not examine the competitive constraints facing hospitals for some or all of their services, and equates "must-have" status and inclusion in the network with market power and the ability to negotiate prices above the competitive level in all contexts.
- Third, the Article asserts that the pricing of all hospitals within a system reflects the assumed market power of the "flagship" hospital, without any examination of empirical support for differentiation in pricing or the sources of such differences.
- Fourth, the Article confuses the interaction between hospitals and consumers, the demand and supply of services, and quality with market power. The fact that consumers (and, therefore, payors) are willing to pay more for hospitals they perceive as better provides an incentive for hospitals to improve services, enhance quality, or expand output of highly demanded services, and to expect an appropriate return on required investments. This gives providers the ability to charge a price sufficient to compensate for the costs associated with developing special product attributes and for the innovation provided to the marketplace. Absent such a return, suppliers would have reduced incentive to make the required investments. The presence of such returns is indicative of the competitive functioning of the marketplace and not of anticompetitive pricing or market power.

[16] The Article, p. 3.

[17] The Article, p. 4.

[18] *See* Section IV below for a detailed discussion of these factors. This hospital reference is an example of the use of the term market power without any market context or reference to market conditions. Los Angeles is among the least concentrated areas in the nation, with large numbers of hospitals, including other large tertiary facilities.

- The Article does take note that failure to have sufficient capital led hospitals in California to be unable to invest in needed seismic or other changes, but does not account for needed investments or issues associated with current payment structures and imbalances between private and government payors.

III. Evaluation of the AG Report's "Correlation" Analyses

This section sets out an evaluation of the AG Report's correlation analyses, which examine relationships between various factors such as CMI and specific measures of prices.

Overview on "prices" in the AG Report

The AG Report collected aggregated price information from three major Massachusetts insurers for use in its analysis. Blue Cross Blue Shield ("BCBS"), Harvard Pilgrim Health Care ("HPHC"), and Tufts Health Plan ("THP") each submitted data on the prices paid to hospitals in their respective networks. The data provided to the AG and the AG's calculations on these data are outlined in the report's General Appendix, but the prices themselves and the formulas used are not included in the report.

For BCBS, the AG calculated its own measure of "price relativities." According to the AG Report, this measure is an index based on a fixed mix of products and services that attempts to control for differences in these characteristics across network providers.[19] The AG used rates and fee schedules provided by BCBS to calculate inpatient, outpatient, and observation patient indices for each hospital. These three indices are then combined using fixed weights to arrive at a single index for each hospital.[20] According to the AG Report, this methodology allows for the comparison of the "pure 'price' that insurers negotiate with different hospitals."[21]

HPHC and THP keep "payment relativity" data, and the AG Report uses this as a price measure for those health plans. Payment relativities themselves do not completely control for such factors as product and service mix and acuity. In an effort to control for these factors, the insurers adjusted the payment relativities to take into account "volume, product mix, service mix, and other factors particular to a hospital's payment history."[22] Since the methodology used by the insurers is not described in the AG Report, it is not obvious that this is enough to correct differences in provider prices driven by differences in these factors. The AG Report admits that "the adjustment may not fully account for differences in product and service mix."[23]

In our evaluation of the AG Report's analyses, we made use as best as possible of the aggregate price information that we could glean from the Report's tables and graphics. In addition, we

[19] The basket of products and services is based on BCBS's network-wide revenue mix. *See* AG Report, General Appendix, p. 2.

[20] The weights are based on the network-wide mix of inpatient, outpatient, and observation revenues. *See* AG Report, General Appendix, pp. 3-4.

[21] AG Report, General Appendix, p. 1.

[22] AG Report, General Appendix, p. 4.

[23] AG Report, General Appendix, p. 1.

used revenue and cost information from Medicare Cost Reports, which provide useful measures of "price" or cost and include variables used in the healthcare literature.[24]

The AG Report discusses pairwise correlation analyses between prices and a few variables, including CMI, teaching status, and DSH status. In what follows, we review these correlations and present corrected results. However, as discussed in the next section, we find more appropriate the use of a multivariate analysis in which these and other factors that affect health care prices can simultaneously be taken into account.

A. CMI

The AG Report states that "the prices paid to hospitals do not correlate to the acuity or complexity of the cases handled by the hospital as measured by the hospital case mix index (CMI)…,"[25] but reports no statistical results such as correlation coefficients. Contrary to the AG Report's assertion, by extracting the underlying data from the Report,[26] and re-estimating the relationship, we find that there is correlation between CMI and the prices in the Report.[27] These correlations likely fail to capture fully the relationship between prices and CMI because the AG Report incorrectly attempts to estimate the relationship between prices and CMI when the price measures used were already adjusted by CMI.

The table below shows that, even when improperly adjusting prices by CMI, there is a positive relationship between CMI and prices for the three insurers for whom data are reported in the AG Report.[28] Overall, the AG data appear to show a positive and significant correlation between *CMI-adjusted* prices and CMI.[29]

---

[24] Appendix A describes the methodology used to estimate prices from the Medicare Cost Reports.

[25] AG Report, p. 17.

[26] Since we did not have access to the actual data used by the AG, and instead extracted the data from the Report's charts, there could be minor differences between the data shown here and the actual data used in the AG Report.

[27] The correlation between prices and CMI is higher if potential outliers such as hospitals located on the islands off the coast of Massachusetts, Nantucket Cottage and Martha's Vineyard, are excluded. Without these hospitals, the correlation coefficients are 37% for BCBS, 24% for HPHC, no change for THP (because the data in the Report do not include these hospitals), and 25% for all three insurers combined. These hospitals are small and likely subject to seasonal peaks. The AG Report does not exclude any potential outliers from its calculations.

[28] Correlation coefficients are calculated using standard statistical techniques. For convenience of exposition, correlation coefficients are shown as percentages.

[29] As discussed below, this correlation analysis has little or no economic significance because the AG Report used price data that had been adjusted by case-mix. It is also unclear whether the AG weighted the observations by hospital's size (measured, for example, by the number of beds or discharges). In any case, we find that the combined prices for the three insurance plans show a statistically significant correlation with CMI (unweighted), with a p-value of 0.027. This correlation is also statistically significant if the observations are weighted by hospital discharges in FY 2008 (available from the Massachusetts Division of Health Care Finance & Policy ("DHCFP")). The individual plan correlation coefficients are statistically significant when weighted by discharges, but not significant when unweighted. If island hospitals are excluded, the individual coefficients are always significant for BCBS and HPHC, but only significant for THP when weighted by discharges.

Insurer	Correlation Coefficient between Relative Payments and CMI (AG Report Data)*
BCBS	13%
HPHC	11%
THP	22%
All Three Insurers Combined**	16%

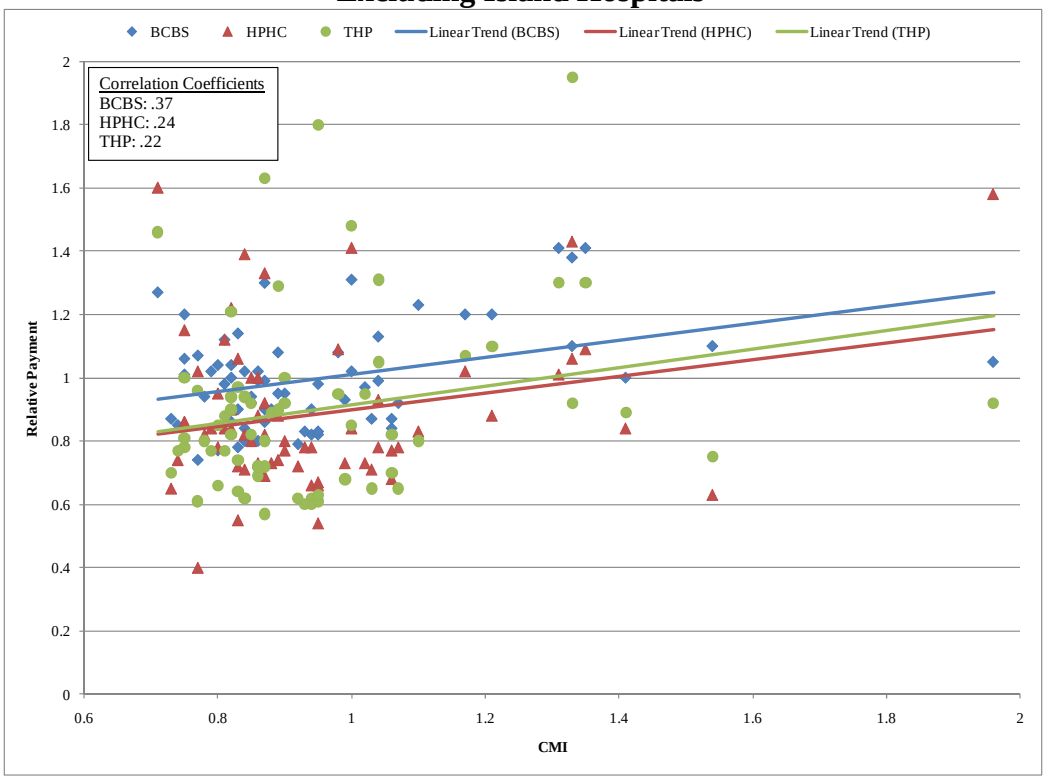
Source: AG Report, pp. 18-19

* Correlation coefficients are not weighted by hospital size. Weighted by discharges, the correlation coefficients are: BCBS: 64%, HPHC: 31%, THP: 50%, All: 46%

** To calculate the correlation coefficient for the three insurers combined, relative payments in the AG report were normalized. The results are similar if relative payments are not normalized.

The scatter plot below shows prices and CMI data from the AG Report, with a trendline for each insurer.[30]

Estimated Correlation between CMI and Relative Payments in the AG Report, Excluding Island Hospitals



Source: CMI and Relative Payments from the AG Report.

[30] This scatter plot excludes island hospitals and does not weight observations by discharges.

As noted above, one of the factors affecting the correlations is that the price measures used were already adjusted by CMI. Two payors (HPHC and THP) provided data on "payment relativity factors" that included a number of adjustments. According to the AG Report, these plans adjusted payments to account for volume, product mix, service mix, differences in the sickness of the patients served, and other unspecified factors. [31] Although the Report does not specify how the health plans made all these adjustments, to the extent that they already adjusted payments by CMI or any other measure of complexity and service mix, correlations using these adjusted rates will not capture the full relationship between CMI and prices. Reported BCBS prices seem to be affected by a similar phenomenon. The Report claims that it made adjustments to BCBS prices and its methodology "controls for differentiating factors such as volume, product mix, and service mix."[32] As such, CMI-adjusted prices will not fully capture the correlation between prices and CMI. The AG later acknowledged this problem and states "comparing case mix to a variable that already adjusts for case mix is a redundant and flawed analysis."[33]

Our results show strong correlation between *unadjusted* prices and CMI. In order to test this correlation, we developed measures for average inpatient hospital revenue per discharge for all Massachusetts acute-care hospitals for which data are available in the Medicare Cost Reports. We estimated average inpatient revenues per discharge for all payor, Medicare and non-Medicare discharges.[34] The results are set out below in two graphics, which show the relationship for all payors, and then separately for Medicare and non-Medicare, with linear trendlines. The results show a high correlation between prices and CMI (89% for all payor, 89% for Medicare, and 83% for non-Medicare).[35]

[31] AG Report, p. 8.

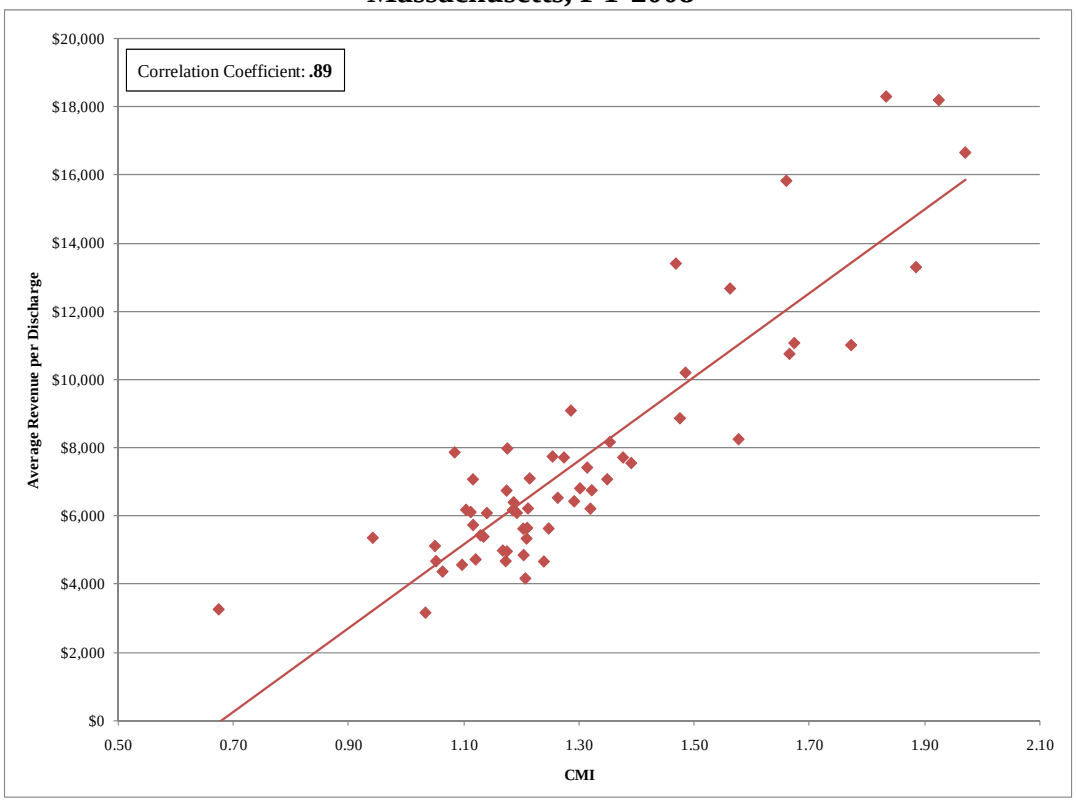
[32] AG Report, p. 8. *See* also General Appendix, pp. 2-4.

[33] *See*, O'Brien, Thomas M., Office of Attorney General Martha Coakley, Letter to Brent Henry at Partners HealthCare System, Inc., June 25 2010, fn. 2. The AG further states: "(1) the BCBS price index is neutral to case mix and (2) the THP and HPHC payments have already been partially adjusted for case mix."

[34] Appendix A describes the methodology used to estimate prices from the Medicare Cost Reports. Charts based on the Medicare Cost Reports do not include some hospitals that appear in the AG Report because they do not appear in the Medicare's Prospective Payment System Final Rule Impact Files, had missing information in the Medicare Cost Reports, or both.

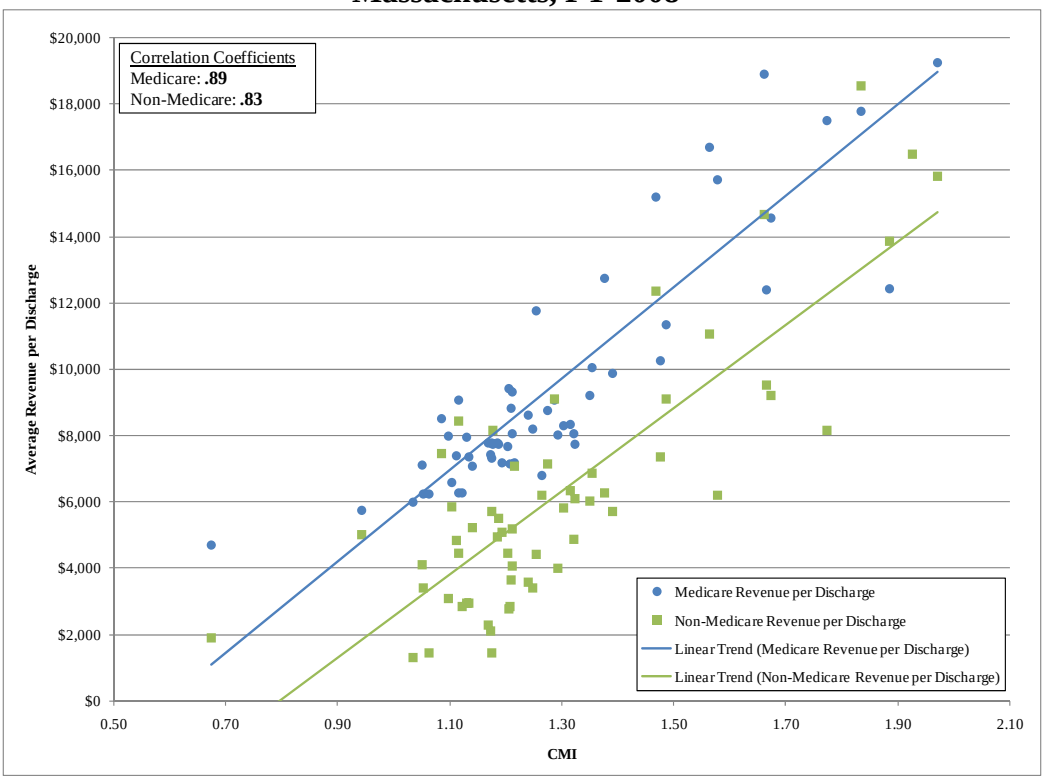
[35] All of these coefficients are statistically significant. The coefficients shown in the charts are not weighted by discharges. Weighted coefficients are similar, 90% (all payor), 92% (Medicare), and 86% (non-Medicare), and in all cases statistically significant.

Average Revenue per Discharge and CMI: Massachusetts, FY 2008



Sources: Medicare Cost Reports, CMS Final Rule Impact Files. Note: Hospitals without CMI or necessary Cost Report information are not included. CMI is transfer adjusted.

Average Medicare and Non-Medicare Revenue per Discharge and CMI: Massachusetts, FY 2008



Sources: Medicare Cost Reports, CMS Final Rule Impact Files. Note: Hospitals without CMI or necessary Cost Report information are not included. CMI is transfer adjusted.

In addition, the AG Report reaches its conclusions that prices are not related to patient severity and complexity of service without an assessment of whether the CMI adjustment fully captures these cost and service attributes.[36] An extensive body of literature describes patient characteristics that may be unobservable but nonetheless distort comparisons because severely ill patients tend to get medical attention at certain facilities. Empirical studies show that health care spending may be affected by factors such as population demographics (age, sex, race, etc.), patient income, baseline health characteristics (self-reported health status, smoking status, BMI, diabetes/hypertension, etc.), previous diagnoses, and risk scores, among other factors.[37] The AG Report does not mention any of these factors, nor does it refer to any of the relevant studies. The CMI adjustment, although appropriate and in the right direction, is a single composite number and does not fully capture the range and mix of services that affect hospital costs.

In sum, the AG Report errs in claiming that prices are not correlated with "the sickness of the population served or complexity of the services provided" because (1) prices are in fact strongly

[36] *See, e.g.*, AG Report, p. 27: "Because the costs shown in this graph are case mix adjusted, differences in the costs cannot be explained by the fact that the costlier hospitals are caring for sicker patients or offering more complex services."

[37] These factors are addressed below in Section V.

correlated with CMI, and (2) the Report did not fully account for the sickness of the population or the complexity of services provided.

B. Teaching Hospitals

The Report concludes that prices are not correlated to or are not explained by whether a provider is a teaching or research facility.[38] These conclusions are rejected by the AG Report's own data. Moreover, the Report uses a very simple measure of teaching status that does not fully capture the teaching intensity and "mission-related" activities of the hospitals analyzed and the costs associated with them.[39] Numerous studies recognize that teaching hospitals have substantial overhead and other costs associated with their provision of services. In fact, a RAND study commissioned by the Massachusetts Division of Health Care Finance and Policy ("DHCFP") expressly cited the extensive literature on teaching hospitals detailing the numerous factors potentially leading to higher costs for teaching institutions.[40] Moreover, the RAND study notes that necessary cost shifting was potentially greater at teaching hospitals than at other hospitals due to the higher proportion of Medicaid and uninsured patients.

There is an extensive body of literature addressing the factors that cause teaching hospitals generally to face higher costs than their non-teaching counterparts.[41] Teaching hospitals conduct the clinical education of all types of health professionals, including resident physicians (*e.g.*, graduate medical education ("GME")). Because of this education mission, teaching hospitals frequently offer the most advanced services and equipment for research and treatment of rare and complex disorders.[42] These mission-related services must be considered as an additional

[38] AG Report, pp. 3, 24.

[39] The term "mission-related" activities is used in this Critique to reflect the provision of services beyond inpatient and outpatient care by teaching hospitals, including the training of physicians for varying specialties that will be deployed outside of the specific institution, medical research, and the maintenance of standby capacity.

[40] Eibner, Christine E., Peter S. Hussey, M. Susan Ridgely, and Elizabeth A. McGlynn, "Controlling Health Care Spending in Massachusetts: An Analysis of Options," *RAND Health*, Submitted to Commonwealth of Massachusetts Division of Health Care Finance and Policy, August 2009 ("RAND Study"), starting at p. 75.

[41] *See, e.g.*, Cameron, James M., "The Indirect Costs of Graduate Medical Education," *New England Journal of Medicine*, Vol. 312, No. 19 (1985). *See also* Commonwealth Fund, "Leveling the Playing Field: Financing the Missions of Academic Health Centers," Report of the Commonwealth Fund Task Force on Academic Health Centers (1997); Dobson, Allen, Lane Koenig, Namrata Sen, Silver Ho, and Jawaria Gilani, "Financial Performance of Academic Health Center Hospitals, 1994–2000," New York: Commonwealth Fund Task Force on Academic Health Centers, (2002); Lambiase, Louis R. and Jeffrey P. Harrison, "The Impact of Graduate Medical Education on Teaching Hospital Efficiency," *Journal of Health Care Finance*, Vol. 34, No. 1 (2007) ("Lambiase and Harrison (2007)"); Rosko, Michael D., "Performance of U.S. Teaching Hospitals: A Panel Analysis of Cost Inefficiency," *Health Care Management Science*, Vol. 7 (2004) ("Rosko (2004)").

[42] In general, specialized services are concentrated in teaching hospitals. For example, the AHA reports that teaching hospitals treat approximately 90 percent of all patients needing pediatric intensive care services and 76 percent of hospitals that provide heart transplant services are teaching hospitals. *See* "Teaching Hospitals: Their Impact on Patients and the Future Health Care Workforce," American Hospital Association, *TrendWatch*, September 2009, pp. 1-2.

"output" – with an associated cost – above and beyond the basic health services provided to their communities.[43] Mission-related costs can be categorized as those related to: (i) GME, (ii) medical research, and (iii) the maintenance of standby capacity for complex and highly specialized cases.[44]

Higher costs associated with these activities, in general, will be reflected in higher reimbursements.[45] Since Congress created the Prospective Payment System in 1983, the relatively higher costs of teaching hospitals have been explicitly recognized by Medicare through payment adjustments for the *direct* and *indirect* costs of GME. The adjustment for indirect medical education costs is used as a proxy to account for a number of factors that can lead to increased costs at teaching hospitals.[46] In addition, despite not being required by statute, Medicaid programs in most states reimburse teaching hospitals for GME and indirect medical education ("IME") costs.[47]

Even the simplistic graphics presented in the AG Report reveal that the presence of large teaching programs is related to "price" measures, and that this result does not depend on assessments of market power or hospital size.[48] For the data as shown in the Report, average prices are between 6% and 16% higher for teaching hospitals depending on the insurer.[49]

[43] Lambiase and Harrison (2007) have documented the need to include GME as an output variable when benchmarking the performance of teaching hospitals. *See* also Rosko (2004).

[44] *See* Koenig, Lane, Allen Dobson, Silver Ho, Jonathan M. Siegel, David Blumenthal, and Joel S. Weissman, "Estimating the Mission Related Costs Of Teaching Hospitals," *Health Affairs*, Vol. 22, No. 6 (2003) ("Koenig et al. (2003)").

[45] *See* RAND Study, p. 75.

[46] *See, e.g.*, "Medicare Indirect Medical Education (IME) Payments," Association of American Medical Colleges, February 2009, p. 1.

[47] *See* Henderson, Tim M., "Medicaid Direct and Indirect Graduate Medical Education Payments: A 50-State Survey," Association of American Medical Colleges (April 2010).

[48] In fact, were these analyses to be run in any large metropolitan area such as New York, it is likely the case that one would observe a correlation between teaching programs and price, even where the individual hospital accounted for a small share of overall discharges or services.

[49] Average prices for the combined insurance plans are higher for teaching hospitals, and this difference is statistically significant (whether prices are weighted by discharges or not). The individual plan correlation coefficients are statistically significant for BCBS and THP when weighted by discharges, but not significant when unweighted.

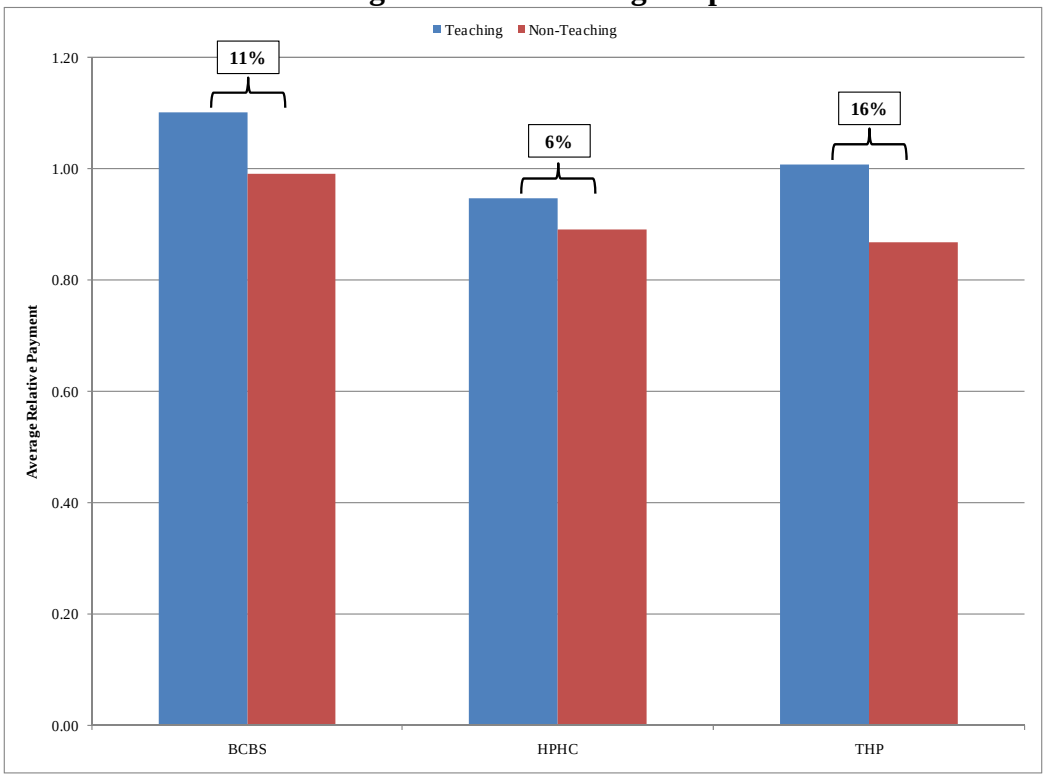
Insurer	Average Difference in Relative Payments between Teaching and Non-Teaching Hospitals (AG Report Data)*
BCBS	11%
HPHC	6%
THP	16%
All Three Insurers Combined**	11%

Source: AG Report, pp. 24-25

* Average relative payments are not weighted by hospital size. Weighted by discharges, the differences increase to BCBS: 20%, HPHC: 7%, THP: 22%, All: 16%

** To calculate the average relative payments for the three insurers combined, relative payments in the AG report were normalized. The results are similar if relative payments are not normalized.

Estimated Difference in Average Relative Payments in the AG Report between Teaching and Non-Teaching Hospitals



Source: Teaching status and Relative Payments from the AG Report. Note: Results are not weighted by hospital size.

Furthermore, the AG Report does not account for differences in teaching and research intensities. Hospitals differ in the number of residency programs, the number of interns and residents, and the scope of associated activities. As discussed below, teaching hospitals also have activities (and costs) that include medical research and the maintenance of standby capacity for complex and highly specialized cases. For example, three of the hospitals identified in the Report have about 500 interns and residents, while other hospitals have fewer than 50 interns and residents.

One measure of a hospital's teaching intensity that researchers use is the number of interns and residents per bed.[50] Medicare also uses this measure to determine supplemental payments for IME.[51] We note that while the Medicare Payment Advisory Commission ("MedPAC") estimated that IME payments were above the level necessary to cover the higher patient care costs of teaching hospitals, this measure of interns and residents per bed may not fully capture the costs associated with other missions of these hospitals that are not directly related to patient care.[52] Koenig et al. (2003) separately estimated the costs associated with the different teaching hospitals' missions.[53] They report that teaching hospitals do more research and have more standby capacity than non-teaching hospitals. They estimate that, overall, mission-related costs account for about 28 percent of hospital inpatient costs per case, where standby capacity represents the largest mission-related cost.

As a preliminary assessment of whether higher prices are correlated to teaching intensity, we plot average inpatient average revenue per discharge from the Medicare Cost Reports and teaching intensity (as measured by the interns and residents per bed). The results are set out below in two graphics, which show the relationship for all payors, and then separately for Medicare and non-Medicare discharges, with linear trendlines. The results show strong correlation between prices and teaching intensity (74% for all payors, 91% for Medicare, and 59% for non-Medicare discharges), even after adjusting prices by CMI.[54]

[50] *See, e.g.*, Koenig et al. (2003).

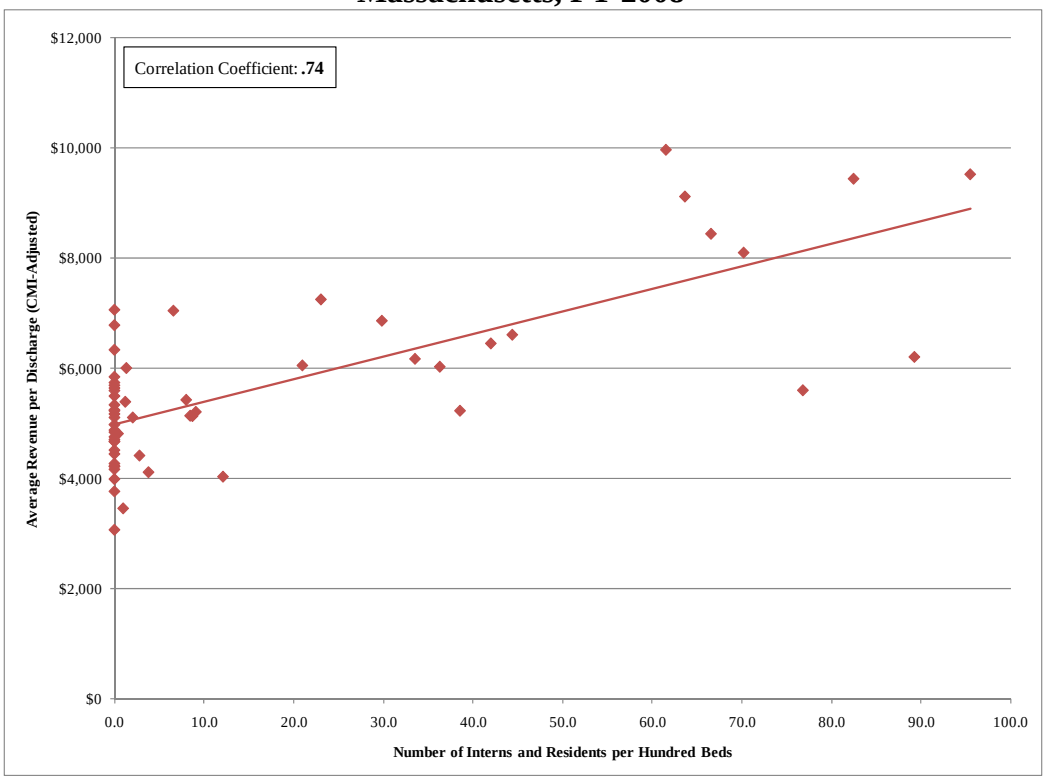
[51] *See* https://www.cms.gov/AcuteInpatientPPS/07_ime.asp (accessed September 28, 2010).

[52] *See* Medicare Payment Advisory Commission, "Report to the Congress: Aligning Incentives in Medicare," June 2010, p. 109.

[53] *See* Koenig et al. (2003). In order to obtain measures of the hospital's research mission, the authors used the amount of funding from the National Institutes of Health, whether the hospital has a general clinical research center, and whether the hospital has a positron emission tomography scanner. To measure standby capacity, they relied on the number of specialty care beds, the availability of sophisticated clinical services, and the number of solid organ transplants.

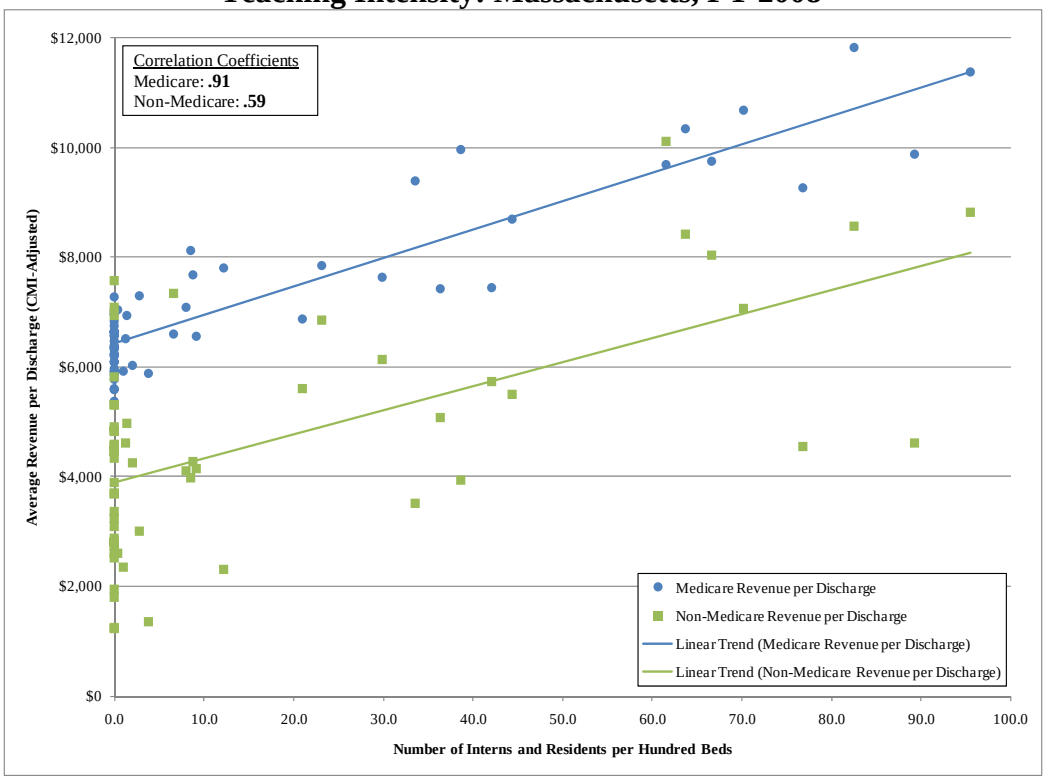
[54] All of these coefficients are statistically significant. The coefficients shown in the charts are not weighted by discharges. Weighted coefficients are similar, 76% (all payor), 93% (Medicare), and 64% (non-Medicare), and in all cases statistically significant.

Average Revenue per Discharge (CMI-Adjusted) and Teaching Intensity: Massachusetts, FY 2008



Sources: Medicare Cost Reports, CMS Final Rule Impact Files. Note: Hospitals without CMI or necessary Cost Report information are not included. CMI is transfer adjusted.

Average Medicare and Non-Medicare Revenue per Discharge (CMI-Adjusted) and Teaching Intensity: Massachusetts, FY 2008



Sources: Medicare Cost Reports, CMS Final Rule Impact Files. Note: Hospitals without CMI or necessary Cost Report information are not included. CMI is transfer adjusted.

C. "Leverage"

The AG Report defines leverage as "the ability of insurers and providers to influence each other during contract negotiations."[55] In assessing provider leverage, the AG Report uses two measures – the total revenue paid by an insurer to a hospital system and the number of an insurer's enrollees that obtained care at a provider's system.[56] The AG Report then evaluates the variation in payment rates among six academic medical centers in Massachusetts based on these measures. There are a number of methodological and theoretical issues associated with any inferences drawn from these measures and estimated relationships.

First, the AG measures of "leverage" are flawed and do not represent measures of market power or anticompetitive power over price. They are simply measures of overall payments made by an insurer to a health system or of numbers of an insurer's enrollees served by a specific health system. There is limited context provided with regard to the *relative* size of a provider or provider system for hospital services generally. For example, the AG Report would treat similarly each and every major hospital in New York City as having leverage without regard to

[55] AG Report, General Appendix, p. 7.

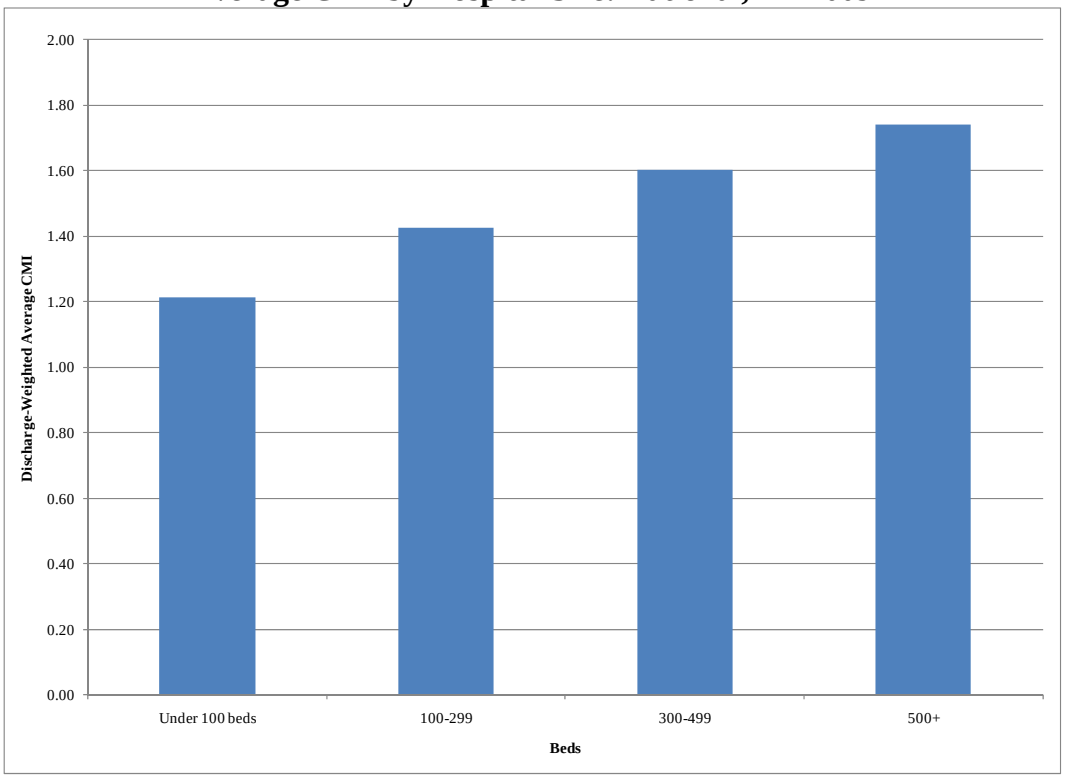
[56] AG Report, General Appendix, p. 7. The AG Report relates size to the "disruption" that the insurer would face if the provider were not included in the network, but does not provide any logic as to how either accounts for market power.

relative size, that the New York area is an unconcentrated market, and that there are a significant number of larger specialized hospitals.

Second, when the AG Report examines the relationship between size and payments, even within its small sample of hospitals, it incorrectly concludes that observed price differences are the result of large hospitals' "leverage." This conclusion fails to take into consideration that size (whether revenues or numbers of patients served) is related to other factors such as CMI, number of beds, and teaching intensity, which individually and collectively are related to costs and payments. Hence, the AG Report's analyses fail to identify competitive sources of payment differences and attribute them mistakenly to market power or leverage.

As noted earlier, there tends to be a correlation between payments and CMI, as well as between payments and other metrics such as teaching intensity; these relationships are obscured and missed in the AG Report's analyses. We develop the following analyses using national data on hospitals to provide a more comprehensive sample than six hospitals in Massachusetts. As is shown in the graphic below, CMI on average increases with bed size.

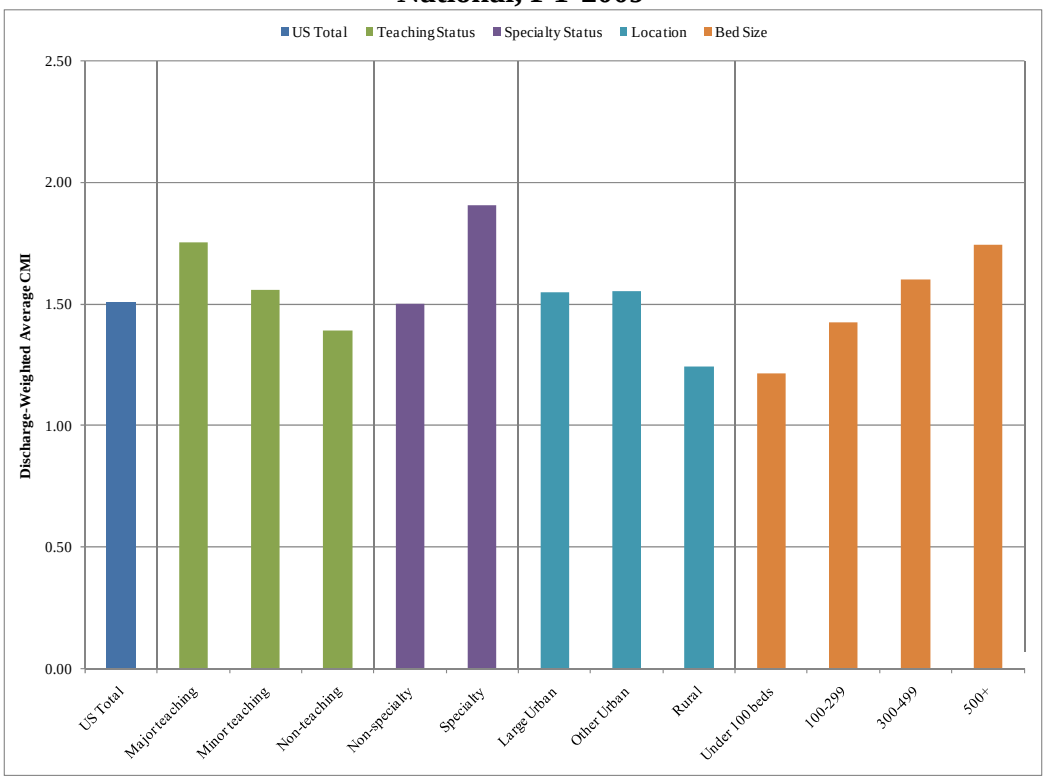
Average CMI by Hospital Size: National, FY 2009



Source: CMS FY 2009 Final Rule Impact File.

In addition, as shown in the following graphic, CMI tends to be higher for urban and teaching hospitals – although many of these attributes may overlap (that is, teaching hospitals may be more likely to be in urban areas).

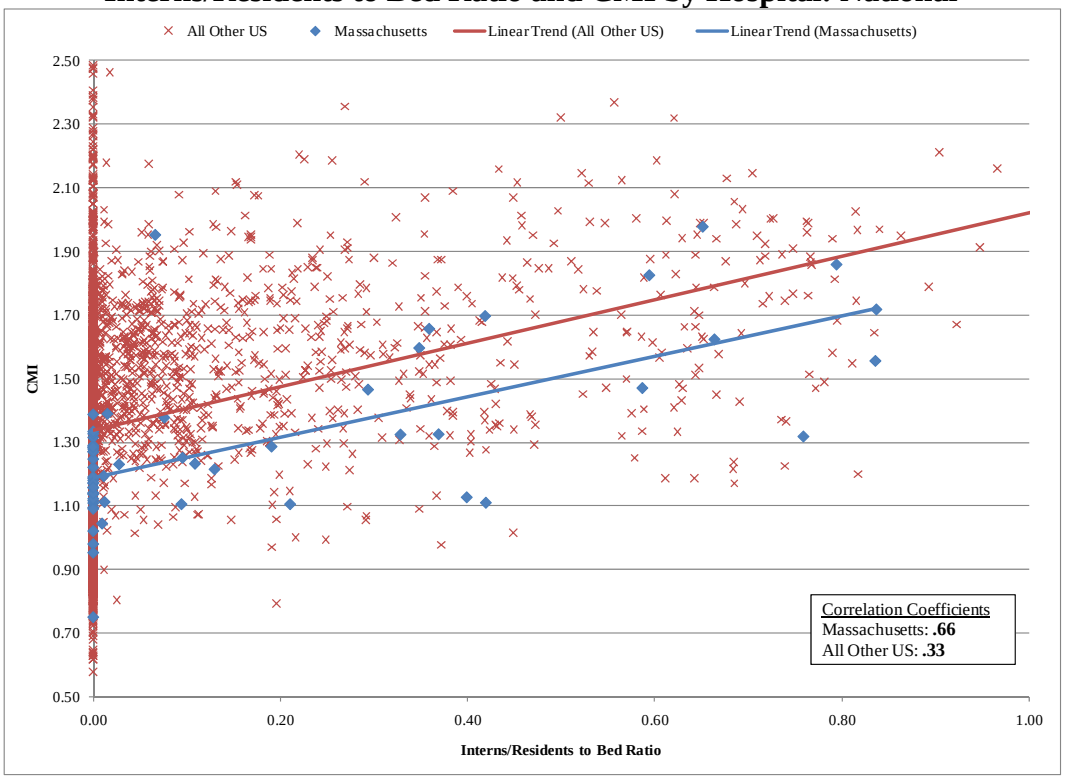
Average CMI by Various Hospital Characteristics:
National, FY 2009



Source: CMS FY 2009 Final Rule Impact File.

We also examined the relationship between teaching intensity and CMI for both Massachusetts and all U.S. hospitals. The scatter plot and trendlines below show that there is a positive relationship.

Interns/Residents to Bed Ratio and CMI by Hospital: National



Source: CMS FY 2009 Final Rule Impact File. Note: Axes restricted to not show possible outliers.

All of these analyses show that large hospitals tend to have higher CMI and teaching intensity. This implies that the simple correlations of the AG Report between its leverage measure and price are likely to be capturing the effects of one or more of these measures, and mistakenly attributing price differences to market power. In the next section, using multivariate analysis, we show that once other relevant variables such as CMI and teaching intensity are included in the multivariate analysis, hospital size is no longer a statistically significant factor in explaining hospital prices.

Third, the AG Report fails to take into consideration that demand for a hospital as measured by volume of patients served can reflect the perceived and actual quality of services offered at the hospital. Nor does the Report take into account the higher costs associated with investments in technology and staffing that are required to offer high levels or service, and that returns are required in order to induce the continued investments (and to provide incentives and capital for re-investment).

Fourth, the leverage analyses in the AG Report are static and based solely on claimed relationships between size and payments. There is no evaluation of competitive constraints or the use of mechanisms by payors or others to discipline pricing. In particular, there is no context provided to examine share or structure, including competitive alternatives to the hospitals studied.

Last, the leverage analyses are inconsistently applied to include large *and* small hospitals: the initial AG Report also identified "geographically isolated" hospitals, many of which are very small, as having market power over insurers independent of their smaller size.[57] Just as in the case of larger hospitals, there is no assessment of other factors such as the costs of these hospitals or competitive conditions in which they actually operate in evaluating their prices. The initial AG Report thus managed to claim both that higher prices are due to leverage based on a hospital's large size *and* that very small hospitals similarly have market power.

IV. Extension from Univariate to Multivariate Analysis

A fundamental issue with the AG Report is that it is based on univariate analyses.[58] A review of other studies that examine sources of differences in prices or costs among regions or hospitals shows that they (1) tend to be based on analyses that involve multiple statistical relationships (*i.e.*, "multivariate" analyses) with substantial effort to establish an underlying model of causal factors; (2) include a number of factors identified as potential sources of cost or service differences that are not examined in the AG Report; (3) find substantial empirical relationships between these factors and measures of price or spending; and (4) show greater explanatory power than simplistic univariate analyses. In order to provide context for the assessment of price differences, we review these studies and the factors assessed therein.

We conduct some preliminary analyses focusing on some of the variables used in the AG Report as a means to show different insights as the analyses are enriched by moving from single variable correlations to analyses that examine the effects of multiple factors.

Preliminary multivariate analyses show that a few key variables appear to explain a very large share of the observed price variation in Massachusetts. Since the AG Report does not provide sufficient data for this analysis, we developed measures of prices based on Medicare Cost Report data.[59] The table below shows the regression results for the estimated non-Medicare inpatient

[57] Office of Attorney General Martha Coakley, "Investigation of Health Care Cost Trends and Cost Drivers, Preliminary Report," January 29, 2010, pp. 14-15.

[58] We use the term univariate analysis to refer to the correlation calculations between prices and a single variable, as shown in the AG Report. Multivariate analysis involves more than one explanatory variable at a time. In this case, we use regression analysis in which a dependent variable (*e.g.*, non-Medicare prices) is explained by a set of explanatory variables (*e.g.*, CMI, DSH status, teaching intensity). As discussed before, univariate analyses cannot capture the complexity of hospital operations. Although univariate relationships may be informative, one cannot calculate a simple correlation and obtain a scientific conclusion on whether the variable analyzed is a relevant driver of hospital prices.

[59] We used revenue and discharge data from the Medicare Cost Reports to estimate average hospital inpatient revenues (per discharge) for Medicare and non-Medicare patients in Massachusetts. The Cost Reports do not provide sufficient data to isolate revenues from commercial payors. Instead, the calculated non-Medicare inpatient revenues include an average for commercial payors, Medicaid, other government, and self pay and uninsured patients. Other limitations of the Cost Reports are that they do not provide actual payments (only charges) for inpatient services from payors other than Medicare, and that they only provide payment data for all the hospital's patient services (that is, for both inpatient and outpatient services). Following the literature, we apply a hospital-level discount factor to calculate inpatient payments from the reported inpatient charges, and then subtract Medicare payments to obtain

prices per discharge for FY 2008.[60] We moved beyond the simple pairwise comparisons in the AG Report to a regression that simultaneously accounts for the possible effects of CMI, teaching intensity (measured by the number of interns and residents per bed), the hospital's DSH status, and the share of Medicare and Medicaid discharges.[61] The key findings, as shown in the table below, are:

- Hospital revenues per discharge are strongly correlated with case mix and teaching intensity;
- The other two variables, DSH status and share of Medicare/Medicaid discharges, do not appear to be statistically significant in this simplified model; and
- Overall, the R-squared value shows that this simple statistical model accounts for approximately 70 percent of the variability in non-Medicare inpatient prices per discharge.[62]

non-Medicare payments. This calculation implicitly assumes that the discount factor is the same for inpatient and outpatient services. The data and methodology are described in Appendix A.

[60] Due to the data limitations of the Medicare Cost Reports, we used data from AHA to check overall revenues and discharges (with the limitation that not all hospitals report revenues to the AHA Survey). Total discharges and revenues in the AHA data are similar to those in the Medicare Cost Reports, although discharges by payor do not always match those in the Medicare Cost Reports. In addition, we compared discharges in the Medicare Cost Reports to those reported at the DHCFP website. Discharges available from the DHCFP are comparable to those in the Medicare Cost Reports, although again discharges by payor do not always match those in the Medicare Cost Reports.

[61] The AG Report contains inconsistent statements with regard to its conclusions about DSH status and relative prices. In its summary findings, the Report states that prices are not related to DSH status to "the extent to which a provider cares for a large proportion of patients on Medicare or Medicaid;" but then states that commercial insurers tend to pay lower prices to DSH hospitals. AG Report, pp. 3, 21, 23. The AG later conveyed its view that DSH hospitals receive lower prices. *See* Letter to Brent Henry at Partners HealthCare System, Inc., June 25, 2010, fn. 4. These inconsistencies highlight the limitations of univariate analyses for assessing complex and multi-faceted relationships. Multivariate analyses show the complexity of the DSH status variable; controlling for other relevant factors in a multivariate analysis reveals that DSH status is statistically insignificant when using non-Medicare prices and statistically significant when using Medicare prices, suggesting that there are a variety of factors related to DSH status that may be driving the results.

[62] For univariate analyses, the R-squared value is the square of the correlation coefficient. In this context, it means that an appropriate linear combination of these four variables would have a correlation with price of approximately 85% (the square root of 72%). This correlation is high when contrasted with the claim in the AG Report that these variables are not correlated with price.

Explanatory Variables	Dependent Variable Avg. Non-Medicare IP Price per Discharge
Case-Mix Index (CMI)	10,246
	(1,611)*
Teaching Intensity (Interns and Residents per Bed)	3,687
	(1,560)*
Share of Medicare/Medicaid Discharges	4,325
	(2,965)
DSH Recipient	337
	(654)
R-squared value	0.72

Notes:
The regression model includes a constant term. Standard errors shown in parentheses.
Number of hospitals: 59 (fiscal year 2008).
* Results significant at the 5% confidence level.

We conducted the analyses for Medicare, non-Medicare, and all payors, and observe similar relationships with the explanatory variables of CMI and teaching intensity. This result is at odds with the AG Report's argument that the observed differences in negotiated commercial prices are driven predominantly by "leverage" and not related to factors such as CMI and teaching intensity.[63] Our analyses reveal that Medicare and non-Medicare prices are highly correlated in Massachusetts.[64]

Our multivariate analysis suggests that the main finding of the AG Report, i.e., that prices are correlated to provider leverage, is largely a spurious result from using a simple univariate correlation between measures of size and prices to assess the complexity of hospital reimbursements. We added a measure of hospital size to the regression model above (measured by the number of beds or discharges). When the regression model includes CMI and teaching intensity, hospital size does not appear as a statistically significant factor in explaining prices. This applies both to Medicare and non-Medicare prices.[65] Only when one ignores these

[63] The same regression for Medicare prices shows relatively stronger correlation with teaching intensity, weaker correlation with CMI, and a statistically significant coefficient for DSH status (IME, GME, and DSH payments were included in average Medicare revenues). The R-squared value for this regression is 0.96. In addition, the results generally hold for a weighted regression in which the frequency of the observations is based on hospital beds or discharges.

[64] For FY 2008, the correlation coefficient between Medicare and non-Medicare prices is approximately 80%.

[65] For non-Medicare prices, we added the number of beds to the regression model shown in the table above. The coefficient for this variable was not statistically significant (p-value of 0.187) and the coefficients for the other variables did not change significantly (both CMI and teaching intensity had approximately the same magnitude and were statistically significant; the coefficients for DSH recipient and share of Medicare/Medicaid were not statistically significant). As an alternative measure of hospital size, we used non-Medicare discharges. This variable was not statistically significant (p-value of 0.610)

explanatory factors does hospital size appear to be correlated with prices—as the univariate correlation between size and prices captures the fact that large hospitals tend to have high CMI and large teaching programs.

More extensive modeling would likely capture other factors such as regional costs, demographics, health status, and provider and marketplace factors. Even without this more extensive modeling, the results show that a few key variables are able to capture and explain a large share of the variation in hospital revenues. Consistent with the results found in other studies, prices are strongly correlated with case mix and teaching intensity.[66]

A more comprehensive model would incorporate explanatory variables that have been shown in the literature to explain hospital prices and spending. Combinations of these sets of explanatory variables have been used in numerous studies that rely on multivariate regression analysis. These factors include case mix, costs, demographics, health status, provider characteristics, and payor characteristics.[67]

A large number of studies have analyzed Medicare spending by region.[68] These studies generally adjust regional spending by the regional cost indexes provided by CMS. In some

---

and the coefficients for the other variables were largely unchanged. For Medicare prices, we used the number of beds and Medicare discharges. These variables were not statistically significant (p-values of 0.330 and 0.868, respectively) and the coefficients for the other variables in the model did not change significantly (similar magnitude and statistical significance).

[66] It is noteworthy that hospitals prices are also correlated with cost variables, such as hospital assets per bed, staff per bed, average hospital wages, and average inpatient cost per discharge. However, since these variables tend to be correlated with CMI, they do not add much explanatory power to this regression specification.

[67] Case mix variables attempt to capture the mix of services delivered by each provider. Researchers have typically used Medicare's CMI or have conducted the analysis at the DRG level. Costs variables capture regional differences in input costs. In addition, hospital-specific costs, such as staff, wages and capital expenditures, may be used to capture the degree of complexity in hospital services. Demographic variables incorporate the underlying characteristics of the population served. The literature has shown that the overall use of health care services and the prevalence of certain conditions can vary according to age, sex, race, and other socioeconomic variables. Health status variables capture the relative sickness of the population. Researchers have used primarily behavioral variables (*e.g.*, share of smokers) and variables that reflect the incidence of specific conditions (*e.g.*, previous diagnosis of diabetes). Provider characteristics capture certain costs or organizational factors that affect hospital revenues (*e.g.*, mission-related costs of teaching hospitals, uncompensated care). Researchers have also used them to measure the relative supply of health care resources. Payor characteristics have been used in studies that attempt to explain health care outcomes through variables that identify payor mix, payor concentration, and other payor characteristics.

[68] *See*, *e.g.*, Cutler, David M., and Louise Sheiner, "The Geography of Medicare," *American Economic Review*, Vol. 89, No. 2 (1999) ("Cutler et al. (1999)"); "Measuring Regional Variation in Service Use," Medicare Payment Advisory Commission, Report to Congress (December 2009); Zuckerman, Stephen, Timothy Waidmann, Robert Berenson, and Jack Hadley, "Clarifying sources of Geographic Differences in Medicare Spending," *The New England Journal of Medicine*, Special Article (May 2010); "Geographic Variation in Health Care Spending," Congressional Budget Office (February 2008); "Geographic Variation in Health Care Spending: A Closer Look," American Hospital Association, TrendWatch (November 2009). In addition, research from the Dartmouth Atlas Project includes Fisher, Elliott S., Julie P. Bynum, and Jonathan S. Skinner, "Slowing the Growth in Health Care Costs – Lessons from

cases, they also adjust for case mix. Since these studies look at overall spending, which is affected by utilization, their models tend to include a large number of variables that attempt to capture demographic characteristics (*e.g.*, age, sex, race, income, urbanization) and health status of the population (*e.g.*, self-reported health status, share of smokers, mortality rates, and incidence of certain conditions). They also include variables that measure the supply of medical resources in the region, including the percentage of primary care physicians and the availability of teaching hospitals. In some cases, they also include payor-side measures, such as the share of the population on managed care, Medicaid, and uninsured.

Although these studies do not always report the variation of prices explained by their models, many of the variables included in the models appear as significant in explaining Medicare spending. For example, Cutler et al. (1999) found that variables related to health status explain 66 percent of the variability in Medicare spending, with population demographics and the supply of medical care increasing the explained variation to 70 percent and 75-80 percent, respectively.[69]

A few studies have analyzed non-Medicare costs or prices.[70] One limitation for these studies is that non-Medicare data are not readily available. Researchers have used the CMS Cost Reports to obtain data for non-Medicare patients, or have used payor data limited to a particular state. These studies also make use of the cost indices provided by CMS and either adjust for case mix or analyze the data at the DRG level. In some cases, they also include demographic variables. Since they analyze hospital-level data, the datasets used generally do not include demographic and health status information for the population served at each hospital. Instead, they use variables that attempt to capture hospital complexity (*e.g.*, teaching hospitals, interns and residents), measures of specialty care, and sophisticated clinical services (*e.g.*, open-heart surgery, organ transplants, angioplasty facilities), among other hospital characteristics, such as ownership type.

Finally, all empirical studies have some price variation that cannot be explained by the model. This is because a simplified model cannot capture all the idiosyncratic factors that affect each hospital's costs and rate negotiation process. One should not assume, however, that any residual variation not captured by the model reflects inefficiencies or market power. The AG Report makes this assumption when it attempts to isolate only one reason for differences among provider prices. When it cannot find correlation with the individual single variables and hospital prices, and finds instead a correlation with its measure of "leverage," the AG Report reaches the

---

Regional Variation" *The New England Journal of Medicine,* Perspective (February 2009); "The Policy Implications of Variations in Medicare Spending Growth," The Dartmouth Atlas of Health Care (2009); Fisher, Elliott S., David E. Wennberg, Therese A. Stukel, Daniel J. Gotlieb, F.L. Lucas, and Etoile L. Pinder, "Implications of Regional Variations in Medicare Spending - Part I" *Annals of Internal Medicine,* Vol. 138, No. 4 (2003); and Fisher, Elliott S., David E. Wennberg, Therese A. Stukel, and Daniel J. Gottlieb, "Variations in The Longitudinal Efficiency of Academic Medical Centers," *Health Affairs* (October 2004).

[69] Cutler et al. (1999).

[70] *See, e.g.*, Koenig et al. (2003); "Cost Efficiency at Hospital Facilities in California: a Report Based on Publicly Available Data," Milliman Inc. (October 2007); and Wu, Vivian Y., "Managed Care's Price Bargaining with Hospitals," *Journal of Health Economics,* Vol. 28 (2009) ("Wu (2009)").

overly simplistic and unsupported conclusion that "[p]rices paid for health care services reflect market leverage."[71]

V. Incorrect Assessment of Cost Drivers in the AG Report

The AG Report asserts that the overall increase in medical spending in the past few years has been primarily driven by provider prices and that these prices do not appear to track costs.[72] This assertion is unsupported, for several reasons: (1) the Report does not provide a methodology to assess whether prices are explained by costs; (2) the Report only analyzes unit costs at six hospitals and extrapolates its unsupported conclusions to all hospitals; (3) the Report adjusts costs by case mix and incorrectly assumes that this adjustment will account for any differences in complexity, severity of illness, and quality of care; and (4) the analysis is primarily focused on cross-sectional comparisons across hospitals (*i.e.*, comparisons that look at differences between hospitals in a single year), without any analysis of basic cost drivers that could have contributed to the increase in health care prices over the years. By looking more thoroughly at how hospital-level input costs have changed over the last few years, it is possible to get a more complete understanding of increases in health care expenditures. In this section, we first examine the approach taken by the AG Report to assess costs, and then develop independent analyses of cost factors.

The AG Report shows the case-mix-adjusted unit costs of six academic medical centers, and reports some variation in these costs among this set of hospitals.[73] By assuming that the hospitals in its sample serve similar populations and have similar quality, and are otherwise similarly situated with regard to factors that could affect costs and hence prices, the AG Report flags as an open question why the observed variation should exist.[74] The AG Report, however, assumes rather than tests whether the quality of services and the population served by the hospitals that it compares are similar. As discussed above, the literature shows that a case-mix adjustment cannot take into account all the differences in complexity, health status, and the severity of illness of the patients that are admitted to each hospital. Moreover, even in the sample of hospitals considered there are differences in size and teaching intensity, as well as other factors.

Regardless of whether some factors explain *cross-sectional* cost differences the Report does not analyze whether these factors explain growth in health care costs *over time*. In fact, most of the AG analyses are based on cross-sectional correlations for a single year. This type of analysis is not informative when attempting to answer questions about changes over time. For example, a study by MedPAC notes that service use varies across regions and is slightly negatively

[71] AG Report, p. 43.

[72] *See* AG Report, pp. 3, 26, 35.

[73] AG Report, pp. 26-27. In addition, the AG Report mentions an analysis conducted by an unnamed provider. *See* AG Report, p. 27.

[74] AG Report, p. 27: "This raises the important question of why it costs more for certain hospitals to provide the same types of services to similar populations at similar quality as those services provided by other hospitals at a lower cost."

correlated with increase in service use.[75] Similarly, a panel at the Robert Wood Johnson Foundation noted that areas with high spending are not necessarily the areas with the highest spending growth.[76]

The AG Report appears to conclude that there are wide differences in costs among hospitals, that these variations are consistent with observed variations in prices, and that these cost variations are not explained by factors such as CMI or teaching status. It is unclear, however, how the AG Report is able to conclude that there is no causal relationship between cost and price:

> It appears that higher prices *are reflected* in higher cost structures, but are not caused by them. We reviewed information showing wide variations in hospital costs that appear to track the amount the hospitals are paid rather than the acuity, complexity, or quality of the hospital's services. (AG Report, p. 26, *emphasis added.*)

To our knowledge, the AG has not used a methodology capable of identifying causality. The only empirical analysis of costs provided in the Report contains case-mix-adjusted costs at six academic medical centers *for one year*. There is no mention of an empirical analysis of the relationship between costs and prices,[77] nor does the AG Report present any analysis of costs over time. As discussed below, there is ample evidence showing that important components of hospital costs have increased over time.

The absence of analyses of costs is an important omission when seeking to understand factors that drive healthcare expenditures. This section examines data and information on costs and factors accounting for cost increases both nationally and in Massachusetts, from DHCFP and the Massachusetts Hospital Association ("MHA").

Overview of Cost Trends: National

A review of the trends in input costs for health care providers shows that hospitals are faced with increased costs. Labor and patient-care costs, which make up a large proportion of hospital costs, have grown considerably over time. On average in the U.S., total hospital costs grew by 7.7 percent annually between 2000 and 2005 and by 7.4 percent from 2007 to 2008.[78] No region of the country is immune from these cost pressures. The chart below shows the average adjusted expense per admission by region of the country. Each region has experienced substantial increases in costs over the period 2000-2008.

---

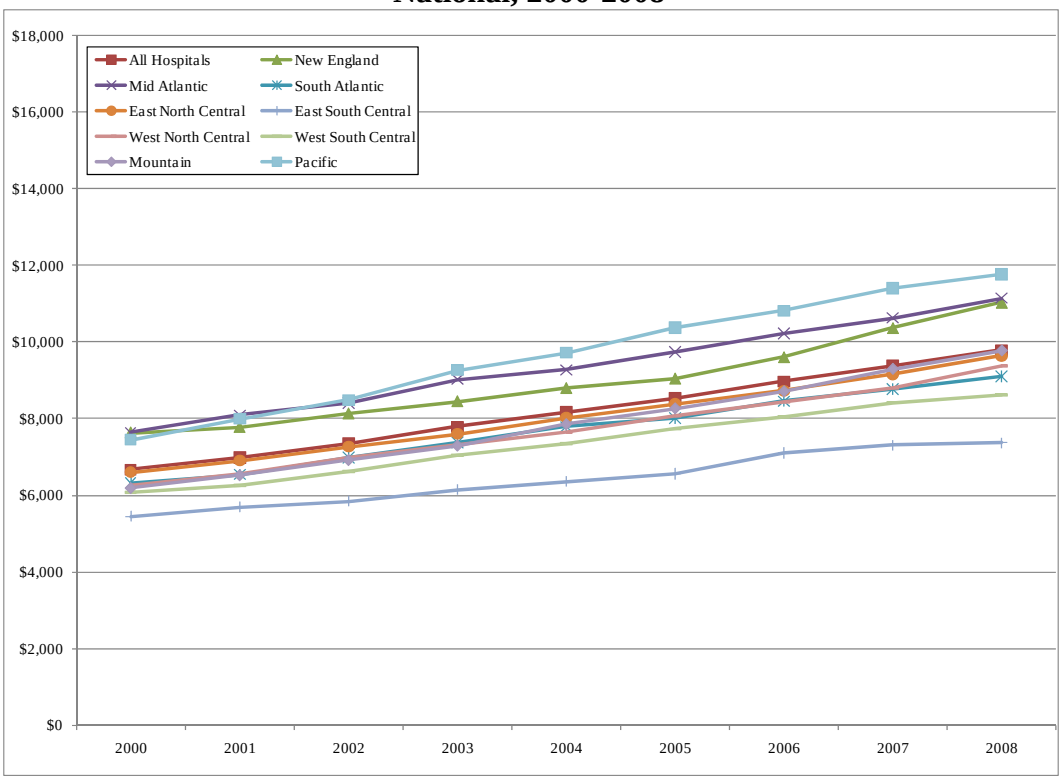
[75] "Measuring Regional Variation in Service Use," Medicare Payment Advisory Commission, December 2009, p. 6. It is important to note that service use "refers to Medicare spending adjusted for Medicare payment rates and the health status of the patient." (*see* Executive Summary, p. vi).

[76] "Geographic Variation and Health Care Cost Growth: Research to Inform a Complex Diagnosis," Robert Wood Johnson Foundation, *Policy Brief,* October 2009, p. 2. The panel also notes that this is consistent with the literature on managed care, "which suggests that the impact of managed care on spending at a point in time differs from the impact of managed care on spending growth" (p. 2).

[77] It should be noted in this context that prices can be explained by costs even if differences in costs are not related to quality or sickness of the population. Exogenous cost factors affect hospital prices over time. In addition, cost factors may affect certain hospitals more than others, even if they deliver similar services.

[78] Analysis of AHA Annual Survey data for community hospitals, 2000-2008.

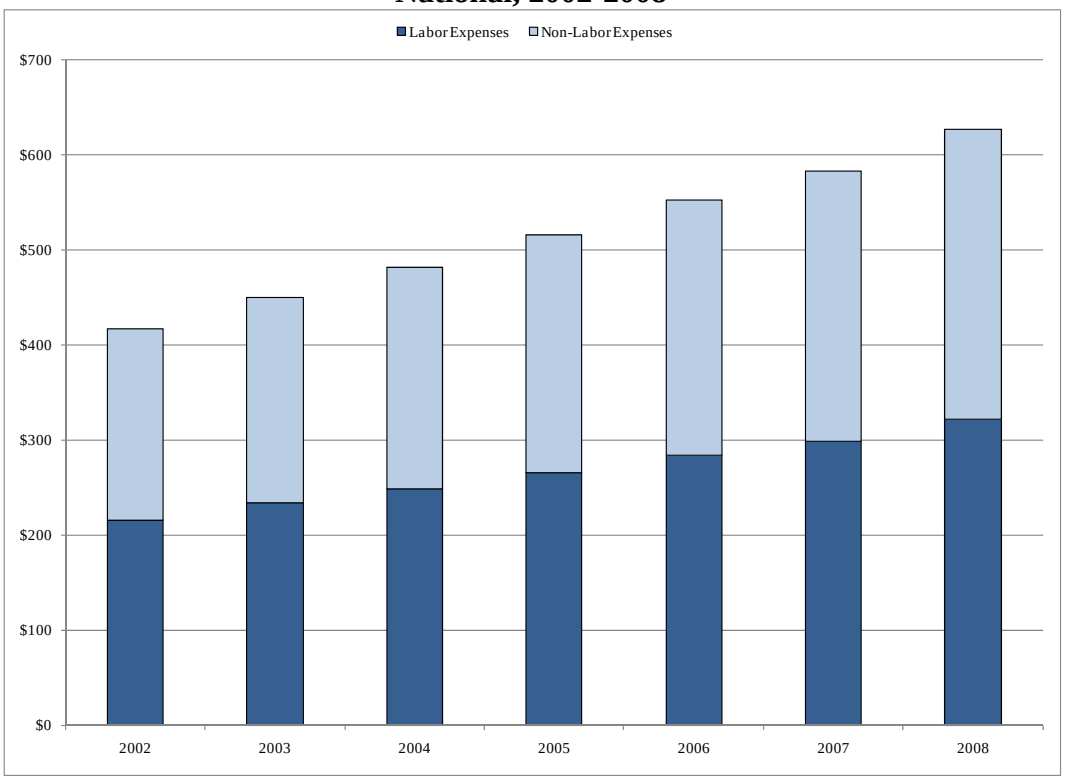
Total Expenses per Adjusted Admission by Region: National, 2000-2008



Source: Analysis of AHA Annual Survey data for community hospitals, 2000-2008

There are many factors accounting for costs and cost increases, most notably labor costs, pharmaceuticals, and new technologies. The chart below shows the overall trend in labor and non-labor costs over the 2002-2008 period.

Total Expenses and Labor Expenses ($ Billions): National, 2002-2008



Source: AHA Annual Survey of Hospitals 2002-2008, data for registered community hospitals

Costs from new technologies include those related to advancements in patient care and treatment, medical devices, and technologies that convey information and knowledge. The Congressional Budget Office ("CBO") has estimated that approximately 50 percent of the health care cost growth during the past several decades is the result of new medical technologies.[79] The CBO identifies a number of technological advances that have increased health care spending. They include revascularization for coronary artery disease, renal replacement therapy for kidney failure, bone marrow (stem cell) transplantation, neonatal intensive care, joint replacement, and diagnostic imaging.[80] Some technologies such as electronic medical records ("EMR") and other information technologies required increased costs in the form of investments and operational costs, with potential payoffs in terms of improved quality of care.[81]

[79] "Technological Change and the Growth of Healthcare Spending," Congressional Budget Office, January 2008 ("CBO Report"), p. 1, and pp. 12-17. Summarizing academic literature on the subject, the CBO report concludes that "the general consensus among health economists is that growth in real health care spending was principally the result of the emergence of new medical technologies and services and their adoption and widespread diffusion by the U.S. health care system." *See* CBO Report, p. 6.

[80] CBO Report, pp. 13-16.

[81] *See, e.g.*, "The Road to Meaningful Use: What it Takes to Implement Electronic Health Record Systems in Hospitals," American Hospital Association, *TrendWatch*, April 2010.

Overview on Cost Trends: Massachusetts

The factors associated with cost increases in Massachusetts are similar to national trends. Data collected by the DHCFP show a wide range of hospital cost structures and costs that have increased each year between 2005 and 2008, as shown in the table below.[82]

Total Patient Expenses Including Capital per Admission

Average Patient Expense per Admission				Percentage Changes			
2005	2006	2007	2008	2006	2007	2008	Avg. Annual Growth
$15,002	$16,058	$17,007	$18,472	7.0%	5.9%	8.6%	7.2%

Source: Massachusetts DHCFP Hospital Summary Utilization Data.

Note: Dana Farber Cancer Institute and Massachusetts Eye and Ear Infirmary excluded due to low admissions.

Data developed by the Massachusetts Hospital Association ("MHA") show that labor and patient-care supplies costs are the two primary components of hospitals' cost structures.[83] The breakdown of cost components and the contribution of each to total hospital costs are shown in the table below for FY 2008.

[82] Expenses per inpatient day show similar trends to those for total patient expenses per admission reported in the table.

[83] "Hospital Costs in Context: A Transparent View of the Cost of Care," Massachusetts Hospital Association, April 2010 ("MHA Report"), p. 1.

Massachusetts Hospital Cost Components (FY2008)

Cost Component	Cost Share FY 2008
Non-MD Salaries and Wages	44.0%
MD Compensation	5.9%
Fringe Benefits	9.4%
Purchased Services (Non-Payroll Labor)	7.0%
Subtotal – Labor Related Expenses	***66.2%***
Food And Food Service Supplies	0.5%
Medical Supplies	1.5%
Drugs	1.1%
Other Supplies And Expenses	21.5%
Professional Liability Insurance	0.2%
Subtotal – Patient Care Supplies	***24.8%***
Utilities And Plant Operations	2.7%
Total Depreciation And Amortization	4.9%
Interest	1.4%
Capital and Other Expenses	***9.0%***

Source: MHA, "Hospital Costs in Context," Table 2.

Several factors contributed to the increase in hospital expenses between 2004 and 2008. Of these, labor is both a large component and one that is increasing rapidly.[84] Non-physician labor expenditures grew by more than a third in four years, from $6.1 billion in fiscal year 2004 to $8.2 billion in fiscal year 2008. During this time, there were significant increases in both the number of staff employed and in compensation, with some of the larger wage increases going to registered nurses.[85]

Costs related to patient-care supplies represent the next largest broad category of hospital expenses in Massachusetts, accounting for about a quarter of total hospital costs. These costs have also increased rapidly over recent years. According to MHA, over the period between fiscal years 2004 and 2008, hospitals have seen aggregate patient-care costs increase by nearly 35 percent.[86] This increase is generally driven by increases both in prices for supplies and equipment and changes in the volume and mix of these inputs.[87]

The MHA data also show inflation rates for hospital purchases, controlling for the mix of inputs.[88] Between fiscal years 2004 and 2008, the inflation rates across all hospital purchases

[84] MHA Report, p. 1 and Table 2.

[85] MHA Report, p. 8. Wages for registered nurses grew by 33.6 percent between fiscal years 2004 and 2008 at Massachusetts hospitals. *See* MHA Report, p. 10.

[86] MHA Report, p. 13.

[87] MHA Report, p. 16.

[88] This approach fixes the weights of the various input components. Therefore, the rate of growth in costs is not affected by changes in input mix over time.

were between 3.1 and 5.4 percent annually (which means that, over this four-year period, the overall inflation rate was approximately 18 percent).[89]

Another effective cost that hospitals face is the payment shortfall resulting from inadequate payments from government. Reimbursements from Medicare and Medicaid have been below the costs associated with serving patients. AHA data show Medicare payment-to-cost ratios declining from 99.1 percent in 2000 to 90.9 percent in 2008 across all U.S. hospitals; additional declines are expected.[90]

With regard to Massachusetts specifically, according to the MHA Report:

> In FY 2008 Medicare paid Massachusetts hospitals 7.3% less than the cost of providing care and MassHealth (Massachusetts Medicaid) paid hospitals 14.2% less than cost. These represented *payment deficits of $317 million and $213 million for Medicare and MassHealth* respectively in the latest of a multi-year period of payment shortfalls under these programs.[91]

The combined effect of the cost and government reimbursement trends is upward pressure on rates in competitive marketplaces.

VI. Conclusions

Understanding the factors that drive healthcare costs and expenditures and seeking solutions that align incentives and organizations to promote efficient and high quality delivery of healthcare are critical elements of healthcare policy. Mistakenly assigning cost or payment differences or their increases to health system size or hospital consolidation risks excluding a substantial number of providers from participation in new organizations and potentially diverts attention from solutions that could address the factors that are driving costs and expenditures. Rather than making broad assumptions about the effects of mergers and consolidation or the formation of new organizations such as Accountable Care Organizations, evaluation should be based on sound economic principles and an examination of very specific facts and circumstances. The focus of the AG Report and the Article on key trends influencing healthcare delivery is an important one; their conclusions that provider organization size and provider consolidation are the primary drivers of price are, however, not empirically supported or well founded.

[89] MHA Report, Table 12, p. 19. Information provided by the Bureau of Labor Statistics shows that the overall increase in the Consumer Price Index over the same period was approximately 10.5%.

[90] "AHA TrendWatch: Key Statistics for Hospitals," American Hospital Association, December 2009, p. 16. Under the recent health care reform, Congress passed legislation that will tend to reduce the growth rate of Medicare spending. *See, e.g.*, "The Effects of Health Reform on the Federal Budget," Congressional Budget Office, Presentation to the World Health Care Congress, April 12, 2010, p. 12.

[91] MHA Report, p. 2, *emphasis in original.*

Appendix A: Data and Methodology

A. Centers for Medicare & Medicaid Services ("CMS") Cost Reports

We use Centers for Medicare and Medicaid Services Cost Reports ("Medicare Cost Reports" or "Cost Reports") to obtain, for each hospital, aggregate estimates of Medicare and non-Medicare average inpatient revenues per discharge. These reports also provide additional information on discharges, hospital characteristics, and Medicare payments. Below is a summary of the main information provided by the Cost Reports:

- Hospital information: type of hospital, control (*e.g.*, non-profit, corporate), urban/rural, teaching, DSH status, number of beds, interns and residents, etc.
- Discharge data: inpatient discharges and outpatient visits (total, Medicare, and Medicaid).
- Total hospital patient charges and net revenue.
- Total Medicare charges, total costs, inpatient revenues, and other Medicare payments (*e.g.*, DSH, IME).
- Hospital costs: average hourly salaries, full-time equivalent staff, and balance sheet data.

One limitation of the Cost Reports is that they do not provide actual payments for inpatient services from each payor. They only provide payment data on total patient services (that is, for both inpatient and outpatient services) and Medicare. Another limitation is that they provide inpatient discharges for Medicare, Medicaid, and a total for all payors. Consequently, one can only calculate discharges for an "other" category that would include third party payors, managed Medicare and Medicaid, self pay (and bad debt), and other payors. The reports are based on each hospital's fiscal year, although the majority of the hospitals in Massachusetts have fiscal years ending on September 30. Observations that reported time periods other than a full year were dropped.

The data used in the correlation and regression analyses are limited to hospitals under the Prospective Payment System (PPS). For other hospitals, the Cost Reports do not provide detailed data to calculate non-Medicare prices, and CMI data are not available from the CMS website.[1] This includes some potential outliers, such as the island hospitals, but no other hospitals were excluded from these preliminary analyses.

Construction of Price Variables

The average hospital inpatient price per discharge can be estimated as:

IP Price (All Payors) = (Total IP Charges * Discount Factor) / Total IP Discharges,

[1] This excludes the following hospitals from the analysis: Dana Farber Cancer Institute, Martha's Vineyard, Nantucket Cottage, Fairview, Athol Memorial, Franciscan Hospital for Children, Children's Hospital, and MetroWest Medical Center (no CMI data for 2008). We included in the analysis all the hospitals identified as General Short Term, Cancer, and Children. However, there were no Cancer and Children hospitals under PPS. The remaining hospitals are all General Short Term Care hospitals and had at least 1,000 discharges during FY 2008.

where Total IP Payments include general inpatient routine care charges, intensive care charges, and inpatient ancillary services charges; the discount factor is based on the ratio of total hospital revenues to total charges (inpatient and outpatient); and discharges exclude swing beds, hospice, and skilled nursing facilities.

For Medicare, the Cost Reports provide data on IP charges, payments and discharges. The average Medicare IP price per discharge is calculated as:

IP Price (Medicare) = Medicare IP Payments / Medicare Discharges

In order to obtain a measure of non-Medicare prices, we follow the formula proposed by Dafny (2007).[2] This formula excludes Medicare revenues and discharges from the average IP price calculation:

IP Price (Non-Medicare) =

(Tot. IP Charges * Discount Factor – Medicare IP Payments) / Non-Medicare Discharges,

where the "Medicare IP Payments," subtracted in the numerator, include DSH, IME, GME and other revenues from Medicare. Hence, all Medicare payments are excluded from the calculation of non-Medicare prices.

B. CMS Hospital Inpatient Prospective Payment System ("PPS") Final Rule Impact Files

Available for download from the CMS website,[3] the Final Rule Impact Files contain information for hospitals reimbursed under PPS. In addition to basic variables specifying the location of each hospital such as region and county, information is also provided on Case Mix Index (including transfer-adjusted), beds, resident to bed ratio, DSH adjustment, and various other factors that Medicare uses to adjust PPS payments. As noted above, hospitals with no CMI data (typically non-PPS hospitals) were excluded from the analysis.

C. Massachusetts Division of Health Care Finance & Policy ("DHCFP") Hospital Summary Utilization Data – HSD10 403 Stats Revenue Cost Files

Available for fiscal years 2005 through 2008 at the DHCFP website,[4] the HSD10 file contains information on the revenue, expenses, and utilization of Massachusetts hospitals. Revenue measures include total net inpatient and outpatient service revenue. Expense measures include total inpatient and outpatient expenses, both including and excluding capital. Utilization measures include total inpatient days, total admissions, and percentage occupancy.

---

[2] Dafny, Leemore S., "Estimation and Identification of Merger Effects: An Application to Hospital Mergers," *Journal of Law and Economics*, Vol. 52, No. 3, p. 531 and fn. 13.

[3] http://www.cms.gov/AcuteInpatientPPS/01_overview.asp#TopOfPage (accessed September 29, 2010)

[4] http://www.mass.gov/?pageID=eohhs2subtopic&L=6&L0=Home&L1=Researcher&L2=Physical+Health+and+Treatment&L3=Health+Care+Delivery+System&L4=DHCFP+Data+Resources&L5=Hospital+Summary+Utilization+Data&sid=Eeohhs2