Effects of the Medicare Prospective Payment System on Hospital Cost Containment: An Early Appraisal

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IN THE 1970S AND EARLY 1980S IT WAS COMMONLY believed that the control of hospital costs could only be achieved by regulatory mechanisms that applied to the hospital system as a whole. There was a clear rationale for this view, namely that, if one controlled only one segment, costs would merely be shifted to the unregulated segment and no overall cost reductions would occur. Certificate-of-need and state rate-setting programs had this underlying philosophy.

While rate-setting controls did not apply to all payers of hospital care, this lack of coverage was the result of political reality. That is, in most states proponents of hospital rate setting did not have the necessary votes to pass such legislation. In principle, stringent regulation must achieve cost containment, but the political will to do so often did not exist. This was due to concern over possible adverse side effects on providers or classes of patients and the concern of some payers that their own, effective, individual actions would be watered down by an all-payer system. There is some evidence, for example, that Medicare lost money when it joined all-payer state rate-control systems (Morrisey, Sloan, and Mitchell 1983), fundamentally because

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they had obtained appreciable discounts from charges which had to be "levelled up" (Ginsburg and Sloan 1984).

During the 1980s, the vocal proponents of cost containment have stressed individual actions rather than strategies to cover all payers or all hospitals. Each purchaser is to do the best it can to constrain the growth of its own outlays. If cost shifting results, it is now widely believed to be the victim of the shifting that is to blame. To avoid being a victim, a purchaser has to be vigorous in cost containment. By implementing a variety of offensive and defensive strategies, it is held that systemwide cost containment will be achieved. This view is held by the Reagan administration, many in Congress and in the private sector, and many university-based health services analysts. Whether such a pluralistic approach will ultimately achieve its objective without unduly harming those ill-equipped to play the cost-containment game, unfortunately, can only be answered with certainty after the fact.

The most prominent of the new type of cost-containment programs has been the Medicare prospective payment system (PPS). Prior to the passage of the Social Security Amendments of 1983 (P.L. 98-21), Medicare reimbursed hospitals on a retrospective cost basis. The cost-based method, in its pure form, gave hospitals an explicit incentive to spend more. More expenditures generated more revenue. Over time Medicare recognized this deficiency and implemented various limits to hospital behavior. The last of these was included in the 1982 provisions of the Tax Equity and Fiscal Responsibility Act (TEFRA). The TEFRA limits were particularly burdensome to the hospital industry because they capped the growth in Medicare disbursements without letting hospitals share in more than a small part of the savings. The industry supported passage of PPS the following year. Under PPS, Medicare pays hospitals a fixed price per case type or diagnosis-related group (DRG). Rather than develop hospital-specific prices as many state rate-setting programs have done, PPS pays the same set of prices for large numbers of hospitals. This is truly a major departure from past practice. The incentive given the hospital under the new payment system is to constrain costs privately because any savings accrues to the hospital itself. Congress, however, also specified that PPS was to be "budget-neutral" through fiscal year 1985. That is, Medicare was to pay hospitals no more nor less than it would have paid them under TEFRA.

To ease the pain of adjustment, PPS was to be phased-in over three years. During a hospital's 1984 fiscal year, Medicare paid one-fourth of its operating-cost obligation under PPS and three-fourths under the old cost-based rules. In each succeeding fiscal year, PPS was to cover an additional one-quarter of the operating obligation and become fully implemented in fiscal 1987. (The phase-in also included provisions for moving from regional to national DRG payments. In 1986 the phase-in was extended for one additional year at essentially the 50/50 blend of PPS and cost-based payment.) Medicare payments for capital costs, medical education, and Part B hospital inpatient costs were excluded from PPS, at least for the program's first few years. States with hospital rate-setting programs could apply for waivers to allow Medicare payment to be based on the state payment principles. Four states had such waivers during the program's first two years: Maryland, Massachusetts, New Jersey, and New York.

Because of fear that providers might go overboard in responding to PPS, Congress charged the "peer review organizations" with monitoring the appropriateness of care for Medicare patients under PPS. The Utilization and Quality Control Peer Review Organizations (PROs) were created by TEFRA in 1982 but did not become operational until mid-1984. PRO reviews could result in denial of payment and a pattern of hospital abuse could result in more detailed reviews and ultimate termination of the hospital's Medicare participation agreement. The PROs, as a rule, are former "professional standards review organizations" (PSROs). The difference between the PROs and the PSROs is not the personnel or organization involved. Rather, it is the greater pressure to hold hospitals to performance standards and the contract-renewal process placed on the PROs (Lohr and Brook 1984).

In practice, it may be difficult for hospitals to maintain one management style for Medicare beneficiaries and another for patients covered by payers that reimburse according to more traditional methods. There is considerable empirical evidence that pre- versus post-PPS differences in length of stay and ancillary use are about equal for Medicare and non-Medicare beneficiaries (Morrisey, Sloan, and Valvona 1988b; Sloan, Morrisey, and Valvona 1988b). Also, there are indications that PPS has stimulated cost-containment activity on the part of other payers (Guterman and Dobson 1986).

This article addresses the following questions. First, apart from

other influences, did PPS and PROs affect hospital cost per case and per day, profit margins, and the total number of patients admitted to community (nonfederal short-term, general) hospitals? We are interested in cost, profits, and admissions for the hospital as a whole, not only that part paid by Medicare. Second, since PPS applied to hospital labor but not to hospital capital, did hospitals substitute capital for labor? Third, were cost savings also realized in the four states that had Medicare waivers? If so, how did these savings compare? Fourth, judging from the evidence from the first two years, how does the cost-saving potential of the PPS-PRO combination compare with that of the other cost-containment programs such as hospital rate-setting and certificate of need? The key variable of interest is PPS. To isolate its effects, we control for a variety of other influences. Because the PROs were implemented in mid-1984 and effectively part of PPS, however, we are forced to treat them as a single intervention. Thus, we capture net effects.

The following section summarizes the incentives inherent in PPS PROs. We then describe the data and methods we employed. Both descriptive and multivariate results are then presented. Finally, we discuss the robustness of the findings and their implications for cost containment.

Conceptual Framework

Under Medicare, prior to PPS, hospitals were paid on a cost-based retrospective basis. From the hospital's perspective, costs generated revenue. Except for a deductible that was generally satisfied on the first day of hospitalization, the patient essentially received "free" care. Thus, the incentive was to provide any and all services that had some benefit to the patient.

The prospective payment system developed fixed payments for each of 467 categories of diagnoses. To rigorously develop the incentives implicit in this payment change requires a formal framework. Ellis and McGuire (1986) provide such a model. They assume that all patients within payment classes are identical, that all hospitals are identical, that hospitals do not have nonfinancial incentives, that physicians serve as agents for both their patients and their hospitals, that the prospective price equals the amount hospitals would have

been paid, on average, under the old system, and that there are no new organizations that monitored hospital utilization or quality.

Under these conditions it can be shown that employment of personnel and nonlabor inputs, such as supplies and equipment, per case will be reduced as a result of the implementation of PPS and that there will be an increase in hospital profit per case. In general one would expect use of both labor and nonlabor inputs to decline (Ellis and McGuire 1986). Since capital costs continue to be paid on a cost basis, however, they may actually increase as hospitals substitute certain nonlabor inputs such as building and major fixed and movable equipment for labor. Since capital costs associated with such investments are only a small component, overall costs should decline even if such investment increases. The input reduction may take the form of reduced length of stay and/or reduced inputs per patient day. The size of the changes depends upon the extent to which physicians represent the patients' as opposed to the hospitals' interest.

These reductions will have an ambiguous effect on admissions (see Morrisey et al. 1984). On the one hand, leaner staffing and efficient use of certain nonlabor inputs such as supplies will reduce marginal cost, leading hospitals to be willing to treat more patients for a given price. To the extent that patients and their referring physicians perceive a degradation in hospital quality, however, there will be less demand for hospital care.

Since the per case payment covers hospital but not other types of care, where possible, diagnostic and therapeutic procedures will be shifted to an outpatient setting (Iglehart 1986). Earlier discharge may lead to increased readmission rates. Further, one would not expect input use to decline across the board. Increased expenditures on, say, intensive-care-unit utilization may lead to reduced use of other inputs and earlier discharge. As capacity to treat patients on an outpatient basis develops in response to the changed method for paying for inpatient care, shifts from inpatient to outpatient settings will become progressively easier.

Relaxing the Ellis and McGuire assumptions leads to some additional predictions but also increased theoretical ambiguity as to effect. First, suppose that for a given diagnosis there are two types of patients—the "sick" and the "very sick." If we assume that the very sick cost more to treat than the DRG payment, then the average case complexity of the hospital will fall as very sick patients are not treated. Second,

if there are two types of hospitals, one type willing, for whatever reason, to accept the unprofitable patients, then a separating equilibrium occurs. That is, unprofitable patients are dumped on the more receptive hospital. With either of these complexities, it is not possible to predict the effect on admissions. The effects on costs per day, length of stay, and case complexity will vary by hospital type.

Finally, if a utilization, quality-monitoring organization is also put in place and charged with preventing hospitals from altering treatment patterns and admission practices as described above, then a priori predictions are much more difficult to make. They now depend upon the particulars of the limits and the penalties imposed. For example, a hospital's attempt to discharge and readmit a patient may be thwarted by the disallowance of payment for the readmission. Further, if the organization has the authority to disallow the admission of cases formerly treated on an inpatient basis, average case complexity may increase and the number of admissions is less likely to increase. A substantial drop in demand for inpatient use resulting from rationing policies of a utilization review organization would reduce a hospital's marginal cost, at least in the short run. This would make the hospitals more willing to accept inpatients. In the longer run, hospital inpatient capacity would shrink as hospitals close or phase out particular units.

Indeed, the PROs were charged with the review of random cases, pacemaker cases, day and cost outliers, all readmissions within 15 days of discharge transfers, and all uncodable cases (DRG 467). Preadmission reviews were also conducted (Prospective Payment Assessment Commission 1987). In addition, the PRO contracts established targets for reducing admissions for procedures that could be done on an outpatient basis or that were regarded as unnecessary or inappropriate admissions (Grimaldi and Michelette 1984). The Health Care Financing Administration signed contracts with PROs in mid-1984, very soon after PPS first began to be implemented. As a result of this timing, any evaluation of PPS becomes an empirical exercise in identifying the net effect of often opposing incentives. In what follows we refer to the PPS PRO bundle as recent Medicare cost-containment efforts.

Methods

Data

The primary data source for this article was the American Hospital Association (AHA) Annual Survey of Hospitals for the years 1972 through 1985. We supplemented the published data in *Hospital Statistics* with unpublished data from the same surveys. For the descriptive analyses we developed aggregate estimates from responses of individual hospitals.

For the regression analysis we combined data from 48 states plus the District of Columbia (excluding Alaska and Hawaii) for the years 1977 through 1985. An additional year, 1976, was added for construction of lagged dependent variables. The control variables in the regressions came from a variety of secondary sources, particularly the "Area Resource File" (see Bureau of Health Professions 1984 for a description). We estimated regressions for all "community hospitals" and for all "voluntary hospitals" in each state year. Community hospitals are nonfederal short-term and other specialty hospitals as defined by the AHA. Voluntary hospitals are those community hospitals which are private, nonprofit entities.

Dependent Variables

The goal of cost containment is to constrain the growth in real expenditures in hospital care per capita. By "real," we mean net of general inflation, measured here by the Consumer Price Index. Real per capita expenditures can be expressed as:

$$\left[\begin{matrix}\text{Adjusted}\\ \text{admissions}\end{matrix} \times \begin{matrix}\text{Real cost per}\\ \text{adjusted admission}\end{matrix} \times \begin{matrix}\text{Total}\\ \text{margin}\end{matrix}\right] \Big/ \begin{matrix}\text{Total}\\ \text{population}\end{matrix} \quad (1).$$

Admissions are adjusted to convert outpatient visits to inpatient equivalents; total margin is the ratio of total hospital revenue to hospital expenses. The product of adjusted admissions and length of stay is adjusted patient days. Thus, (1) can be rewritten as:

$$\left[\begin{matrix}\text{Adjusted}\\ \text{admissions}\end{matrix} \times \begin{matrix}\text{Length}\\ \text{of stay}\end{matrix} \times \begin{matrix}\text{Real cost per}\\ \text{adjusted patient day}\end{matrix} \times \begin{matrix}\text{Total}\\ \text{margin}\end{matrix}\right] \Big/ \begin{matrix}\text{Total}\\ \text{population}\end{matrix} \quad (2).$$

Further, real costs can be decomposed into labor and nonlabor components. Our analysis focused on the individual elements of equations (1) and (2) and the cost decomposition. Equation (2) gives hospital revenue per capita population. We also conducted regression analysis on investment by voluntary hospitals.

Approach for Determining the Effects of PPS

We performed descriptive as well as regression analysis of hospitals' responses to recent Medicare hospital cost-containment effects. Although the latter has the advantage of controlling for confounding factors, the descriptive analysis helps one interpret the regression results. In our descriptive work we report trends in key hospital performance, cost, personnel, and investment through 1983 and for 1984–1985. To conserve space only the trends for nonwaiver states were reported.

In the regressions, we measured PPS PROs as the fraction of hospital revenue in a state obtained from Medicare times the proportion of Medicare hospital operating expenses covered by PPS in each year (0.50 in 1985, 0.25 in 1984, and 0.00 in prior years). Peer review organizations were implemented for one-half of 1984 and all of 1985. Thus, to the extent that PROs affected Medicare inpatient use, they should have had a much greater impact in 1985 than in 1984.

During the observational period, four states (Maryland, Massachusetts, New Jersey, and New York) had waivers that exempted hospitals in those states from coverage under PPS. Instead, Medicare was included in the rate-setting programs in all four states. The PPS PRO variable was zero in those states for all years. The influence of Medicare cost containment in these states was measured by a rate-setting variable (described below) and, for 1984–1985, the product of this variable and a binary variable taking the value "one" for 1984–1985. The purpose of this interaction was to allow for the possibility that the rate-setting programs became more effective over time and/or could be more stringent when PPS was being applied in the other states. Also, the interaction term allows us to account for the effect of PROs in the waiver states.

Other Regulatory Influences

We defined two variables for states with mandatory hospital rate-setting programs. A mandatory program requires that hospital rates and/or revenue be controlled by a state agency. Our definition excludes rate review programs by private organizations (such as Blue Cross) and state programs that are not binding on the hospital. Previous research has shown that such voluntary programs have not been effective in cost containment (Sloan 1983). The "young rate review" variable is equal to the fraction of hospital revenue in the state and year covered by mandatory rate-setting for programs in their first two years. "Old rate review" is the corresponding variable for programs over two years of age. We included four mutually exclusive binary certificate-of-need (CON) variables: a pre-CON term for the year before, and the year of CON implementation to capture anticipatory effects; old-CON for programs three years of age or older; and post-CON for CON programs in the year prior to and year of their termination. A binary variable also measured the years in which the American Hospital Association's "Voluntary Effort" was in effect. This approach to other regulatory influences is an extension of earlier work (Sloan 1983).

Other Control Variables

Several variables, all state- and year-specific, control for nonregulatory influences on the cost, output, and profit variables. They are: real per capita income; the fraction of patient-care physicians who were general practitioners; the patient-care physician/population ratio; population density; the percentage of the population enrolled in an HMO; a preferred provider organization (PPO) variable taking the value "one" in 1985 in the states California, Florida, and Colorado [Rice, deLissovoy, and Ermann 1986]; the fraction of spending on hospital care accounted for by each of the major third party payers (Blue Cross, Commercial, Medicare, Medicaid); the real wage of manufacturing employees; a time trend to capture the influence of unmeasureable temporal influences such as technological change; and separate variables identifying each of the 49 states. The 49 state variables account for unique time-invariant characteristics of each state not captured by the other independent variables. The rationale for the PPO variable is that less than two million persons were eligible for PPO programs before 1985;

in 1985, over 65 percent of 5.8 million eligible persons were located in three states.

Functional Form of the Equations

The equations were estimated in log-linear form. We took national logarithms of the dependent variables and the continuous-control variables. The other independent variables including PPS PROs were entered in linear form.

Investment Analysis

In results only summarized here to save space, we estimated a modification of the flexible accelerator model of investment (Jorgenson and Stevenson 1967). The observational period was from 1977 to 1985 and the state year was the unit of observation. The data, limited to voluntary hospitals, came from unpublished tabulations of the Annual Survey of Hospitals provided by the AHA. A full explanation of the specification of the investment equation is found in Wedig, Hassan, and Sloan (1989).

Descriptive Evidence

Change in Selected Performance Indicators

Both voluntary hospitals and all community hospitals in nonwaiver states treated fewer patients and kept them in the hospital for shorter periods of time after PPS PROs were first implemented in late 1983 (table 1). Occupancy rates fell dramatically. Mean cost per adjusted admission and per adjusted patient day (in 1985 Consumer Price Index dollars) continued to rise, but at a much slower rate than previously. Hospitals became more profitable. The number of full-time equivalent personnel (FTE) declined, but, for voluntary hospitals, not at the same rate as adjusted admissions and adjusted patient days. The result was that staffing per stay and per day was richer in such hospitals in 1985 than in 1983. For all community hospitals, total full-time equivalent personnel fell at a higher annual percentage rate than did adjusted admissions, but at a lower annual rate than did

TABLE 1
Change in Selected Performance Indicators (Nonwaiver States)

Indicator	Voluntary hospitals				All hospitals			
	1985 value	Annual percentage change			1985 value	Annual percentage change		
		1972–1980	1980–1983	1983–1985		1972–1980	1980–1983	1983–1985
Total adjusted admissions (M)	23.6	2.6%	0.3%	−2.1%	33.6	2.7%	0.0%	−2.3%
Total adjusted patient days (M)	163.1	2.1	0.3	−5.8	231.0	2.1	0.3	−5.9
Mean length of stay	6.9	−0.7	0.0	−3.5	6.8	−0.5	0.0	−3.5
Mean occupancy rate (%)	64.0%	0.0	−1.2	−7.0	61.6%	0.1	−1.1	−7.2
Mean cost per adjusted patient admission ($)	$3,238.1	11.9	14.6	7.0	$3,136.3	11.8	14.6	7.4
Mean cost per adjusted patient day ($)	$473.3	12.4	14.6	11.0	$466.6	12.3	14.3	11.2
Mean total margin	1.084	0.3	0.2	1.4	1.079	0.3	0.2	1.2
Total revenue per capita population ($)	*	*	*	*	$573.1	5.6	8.4	4.6
Total full-time equivalent personnel (M)	1.8	4.7	2.8	−1.6	2.5	5.0	2.3	−2.6
Total investment (MM$)	$8.9	**	9.5	3.5	12.0	**	9.7	−0.1

Notes: M = Million; MM = Billion. All monetarily expressed values are in 1985 dollars (Consumer Price Index deflator).
* Estimates not presented because voluntary hospitals represent only one hospital type providing services to the population.
** Data not available.
Sources: American Hospital Association 1973, 1981, 1986, and unpublished data from 1980, 1983 and 1985 American Hospital Association's Annual Surveys of Hospitals.

adjusted patient days. Total hospital net investment continued to increase in real terms from 1983 through 1985 for voluntary hospitals, but the annual rate of increase was less than during the period of 1980 to 1983. For hospitals overall, there was actually a slight decrease in real net investment during the period of 1983 to 1985 relative to 1980 to 1983.

Assuming that the growth rates observed during 1980 to 1983 would have continued in the absence of Medicare hospital cost-containment initiatives, one may derive "naive" estimates of PPS PRO effects. They are naive because factors other than the Medicare initiatives are not held constant. The effect is measured as the difference between the annual growth rate during 1983 to 1985 and the corresponding rate for 1980 to 1983. They suggest that PPS PROs caused occupancy rates to decline by 6.1 percent during 1985 for all hospitals, cost per adjusted admission to fall by 7.2 percent, full-time equivalent personnel to decrease by 4.9 percent, investment to decline by 9.8 percent, and inflation-adjusted community hospital revenue per capita population to decline by 8.3 percent.

These naive PPS PRO changes in annual trends are considerable by any standard. If the period of 1972 to 1980 rather than the period of 1980 to 1983 were used as a baseline, the implied effects would be greater for total adjusted admissions, total adjusted patient days, and for total full-time equivalent personnel, but would be less for mean costs per adjusted admission and per adjusted patient day. By deflating by the CPI, we have accounted for the influence of general inflation. Thus, by standards of both the 1970s and the early 1980s, an appreciable measure of cost containment was achieved during the period of 1983 to 1985.

Distribution of Hospital Cost by Major Category

Personnel cost as a percentage of total hospital cost declined between 1980 and 1985. The decrease was more rapid in the period of 1984 to 1985 (table 2). Most of the reduction in personnel cost after 1983 was for nursing and other nonphysician personnel. Nonlabor cost as a fraction of total cost increased after 1983 (table 2). Particularly noteworthy was the increase in interest and depreciation expense shares after 1983. Such cost is not covered by PPS. Hospital outlays for

TABLE 2
Percentage Distribution of Hospital Cost by Major Category (Nonwaiver States)

	Voluntary hospitals				All hospitals			
	1980	1983	1984	1985	1980	1983	1984	1985
PERSONNEL								
Physicians and dentists	1.2%	1.1%	1.0%	1.0%	1.2%	1.0%	1.0%	0.9%
Residents	0.9	0.9	0.9	0.9	1.0	1.0	1.0	0.9
Other trainees	0.2	0.1	0.1	0.0	0.1	0.1	0.0	0.0
Nurses	16.2	16.4	16.4	16.1	16.0	16.3	16.3	16.2
Other personnel	32.0	30.6	30.2	29.4	31.4	29.9	29.3	28.6
Employee benefits	7.6	8.6	8.9	8.9	7.6	8.6	8.8	8.8
Subtotal	58.1	57.7	57.5	56.3	57.3	56.9	56.4	55.4
OTHER								
Professional fees	4.9	4.8	4.1	4.0	5.1	4.8	4.4	4.3
Contract nursing	—	0.3	0.2	0.2	—	0.3	0.3	0.3
Depreciation	4.5	4.6	5.0	5.4	4.3	4.4	4.9	5.3
Interest	2.3	2.6	3.0	3.2	2.1	2.6	2.9	3.1
Utility	—	2.5	2.5	2.5	—	2.5	2.5	2.5
Other nonpayroll	30.2	27.5	27.7	28.4	31.0	28.5	28.6	29.2
Subtotal	41.9	42.3	42.5	43.7	42.5	43.1	43.6	44.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cost per hospital (M1985$)	$18.3	$24.5	$25.6	$26.7	$14.8	$18.7	$19.6	$20.5

Note: M = Million.
Source: Tabulations from American Hospital Association Annual Surveys of Hospitals for 1980, 1983–1985.

TABLE 3
Full-time Equivalent (FTE) Personnel (Nonwaiver States)

	1985 FTE	Annual percentage change 1980–1983	1983–1985
Total hospital personnel	2,497,087	2.3%	−2.6%
Administrators	23,758	11.1	1.2
Nurses	749,393	3.3	−2.4
Medical records	35,391	2.9	1.6
Laboratory and radiology	197,347	1.5	−2.2
Therapists	78,164	4.2	−0.3
Dieticians	28,553	−4.8	−6.0
Other personnel	1,324,054	1.8	−3.0

Sources: Bureau of Health Professions 1985, 1986, and unpublished data from the Bureau of Health Professions.

interest rose relative to other expenses in spite of the fact that interest rates fell rather sharply after the early 1980s.

Full-time Equivalent Personnel

Between 1980 and 1983, the total number of hospital personnel in community hospitals increased at a rate of 2.3 percent per year (table 3). During the period of 1983 to 1985, the number of full-time personnel decreased at an annual rate of 2.6 percent. Among the categories listed in table 3, the only ones for which there were increases were administrators and medical records personnel. But, even for these jobs the annual rates of increase were less than from 1980 to 1983. The number of FTE nurses fell by 2.4 percent annually from 1983 to 1985, and the number of dietitians decreased by 6.0 percent per year.

Investment per Hospital

Mean real net investment per hospital (i.e., inflation-adjusted investment after allowance for depreciation) was slightly higher in 1985 than in 1983 for both voluntary hospitals and for community hospitals as a whole (table 4). Total real net investment declined (table 1), but this

TABLE 4
Mean per Hospital Net Investment (Thousands of 1985$) (Nonwaiver States)

	Voluntary hospitals				All hospitals			
	1980	1983	1984	1985	1980	1983	1984	1985
Land	$ 48	$ 65	$ 66	$ 57	$ 35	$ 48	$ 53	$ 51
Building	545	661	743	846	451	538	646	654
Fixed equipment	194	264	340	283	150	207	278	211
Movable equipment	548	851	930	1,034	442	685	772	789
Construction in progress	842	1,032	965	860	624	812	738	598
Total	2,177	2,873	3,044	3,080	1,702	2,290	2,487	2,303

Source: Calculated from American Hospital Association Annual Survey of Hospitals using the implicit GNP price deflator for nonresidential fixed investment.

reflected a slight decrease in the number of hospitals, not a decline in investment per hospital. There was a sharp rise in major movable equipment purchases. Investment in buildings also increased, but this may have been due to an increase in completed projects. Construction in progress was appreciably higher in 1983 than subsequently. Since major movable equipment generally has a much shorter life than buildings, it is not surprising that the share of depreciation expense of total expense increased in table 2.

Regression Results

This section summarizes the key findings of our regression analysis. (The complete regression results are available to the interested reader by request from the authors.)

Effects of the Medicare Cost-containment Initiatives on Hospital Output, Cost, Profitability, and Revenue

We found that the Medicare hospital cost-control effects (PPS PRO) had statistically significant effects (5 percent level or better, two-tail test) for length of stay, labor cost per adjusted admission, nonlabor cost per adjusted admission, and total margin for voluntary hospitals (table 5). The estimated parameters imply that PPS PROs reduced voluntary hospital length of stay by 2.0 percent and labor cost per adjusted admission by 2.2 percent in 1985, a year in which PPS applied to about one-half of operating revenue hospitals obtained from Medicare. At the same time, the PPS PRO coefficient in the nonlabor cost per adjusted admission regression indicates that the initiatives caused a 2.9 percent increase in nonlabor cost per adjusted voluntary hospital admission in 1985. Medicare cost-containment efforts raised the total margin of such hospitals by 1 percent in the same year. Because of the increase in nonlabor cost, the PPS PRO parameter estimate in the cost per adjusted admission equation was not statistically significant at conventional levels, although the best estimate is that PPS PROs reduced cost per adjusted admission in voluntary hospitals by 0.5 percent. Cost per adjusted patient day tended to increase because the appreciable reduction in length of stay swamped the modest decline in cost per adjusted admission.

TABLE 5
Effects of Medicare Hospital Cost-containment Initiatives: PPS 50 Percent Implemented (Nonwaiver States)

Effect on	Voluntary hospitals	All hospitals
Adjusted admissions per capita population	—	−5.3%*
Length of stay	−2.0**	−2.4*
Cost per adjusted admission	−0.5	0.4
Cost per adjusted patient day	1.5	2.8*
Labor cost per adjusted admission	−2.2*	−1.7**
Nonlabor cost per adjusted admission	2.9*	5.0*
Total margin	1.0*	0.5
Revenue per capita population	—	−3.7*

Notes: *Significant at the 1% level, two-tail test.
** Significant at the 5% level, two-tail test.

The overall patterns of PPS PRO effects are similar between all community hospitals and voluntary hospitals. The Medicare-induced increase in nonlabor cost per adjusted admission was stronger, however, in the full sample. Furthermore, PPS PROs had virtually no effect on cost per adjusted admission and appear to have raised per diem cost in the all-hospitals equation. The somewhat smaller effect of PPS PROs on total margin for community hospitals as a whole relative to voluntary hospitals is not statistically significant at conventional levels.

We also estimated equations for adjusted admissions and for revenue per capita population for all community hospitals. The admissions regression attributes a 5.3 percent decrease in adjusted admissions in 1985 to PPS PROs. The effect on revenue per capita population indicates a 3.7 percent decline attributable to Medicare cost containment. The latter result is particularly important since it reflects the composite effect of the underlying factors of cost containment on adjusted admissions, lengths of stay, real cost per adjusted patient day, and on total margins in 1985.

The 3.7 percent effect is only for one year; the model permits one to compute the final cumulative effect if PPS continued in its current form, but 100 percent implemented, on a permanent basis. Based on the model, the program implemented in conjunction with PROs has

the potential of cutting community hospital revenue per capita population by about 20 percent. Such a reduction would take more than a decade to achieve. Since such a cumulative estimate involves extrapolation far beyond the data, it is highly speculative.

Not surprisingly, the estimated PPS PRO effects tend to be less, sometimes far less, than their "naive" counterparts presented above. The naive estimates hold none of the other influences on the dependent variables constant. When the two are in conflict, the regression-based estimates should be taken as the more reliable ones.

Effects of Other Regulatory Variables on Output, Cost, Profitability, and Revenue

The same regressions permit a comparison of the potential savings in outlays for hospital care to be had from waivers to states with mandatory rate-setting programs. In contrast to regular PPS for which there is a three-year phase-in, waivers have been granted with 100 percent implementation in the first year. Hence, the relevant comparison for 1985 is between a 50 percent implemented PPS and 100 percent implemented waivers. Our comparisons are based on the sum of the parameter estimates on the mature rate-setting program variable and the interaction of this variable with a binary variable for 1984–1985.

Two aspects of our estimates of waivers' impacts are noteworthy (table 6). First, most of the per year effects are insignificant at conventional levels, and the effects tend to be smaller than their counterparts for nonwaiver states. This is in part due to our choice of observational period; the major rate-setting programs began before 1977, although some major changes in the number of payers covered occurred during the period of 1977 to 1985. Further, many states placed Medicaid hospital reimbursement under mandatory rate-setting in the 1980s. In previous studies of rate-setting (Sloan 1981, 1983; Morrisey, Sloan, and Mitchell 1983), mandatory rate-setting had statistically significant impacts on cost per unit of output. But even so, the implied effects on real spending on hospital care per capita population were somewhat smaller than those reported for PPS PROs in table 5. Second, the way the rate-setting programs have achieved cost savings has differed from PPS. In contrast to PPS PROs, these programs appear to have achieved their savings primarily through reductions in labor cost per

TABLE 6
Effects of Medicare Waivers

Effect on	Voluntary hospitals	All hospitals
Adjusted admissions per capita population	—	−0.6%
Length of stay	−1.5%	−1.0
Cost per adjusted admission	−1.5	−2.1
Cost per adjusted patient day	−0.6	−1.2
Labor cost per adjusted admission	−2.8	−2.7*
Nonlabor cost per adjusted admission	−0.9	−2.6
Total margin	−0.5	−0.5
Revenue per capita population	—	−3.0*

Note: *Significant at the 5% level, two-tail test.

admission. They did not raise nonlabor cost, cost per adjusted patient day, nor total margin. They have not achieved the reductions in length of stay and adjusted admissions per capita population, however, that were observed in the PPS states.

As in past studies, the regression results do not show that certificate-of-need programs have achieved savings in outlays for hospital care. Unlike previous work, we measured the effect of dropping CON. One potentially interesting result is the increase in nonlabor cost per adjusted admission coincident with the dropping of CON. This result would have greater credence if we had also found that dropping CON led to an increase in hospital investment. Instead, we found no effect.

Effect of the Medicare Prospective Payment Program on Hospital Investment

Holding constant other variables, such as the change in real hospital revenue, we obtained no statistically significant effect of PPS PROs on hospital investment. The PPS PRO parameter estimates were uniformly positive, however, and in one case came close to attaining statistical significance at the 5 percent level. (Full investment results are available from the authors.)

Discussion and Policy Implications

The Medicare prospective payment system provides a set of administered prices. The diagnosis-related groups and the tougher PRO monitoring activity serve to define the "products"; PPS sets the price of each. As such, the program is no more than a sophisticated rate-setting regulatory program. From a systemwide perspective the key differences are Medicare's focus on its own budgetary savings and its departure from hospital-specific payment. This "self-interest" approach has the potential to further independent actions by other payers. It can do so directly through a fear of cost-shifting or more indirectly through changed accounting systems and altered physician-practice patterns which now make it less costly for hospitals to bid for patients from insured groups or otherwise respond to alternative delivery and financing proposals. While PPS PROs are certainly not the solution proposed by competition advocates, they do serve to identify what can be done with self-interest and market share.

At least by the standards of the 1970s and early 1980s, the period of 1984 to 1985 was favorable for hospital cost containment. The estimated PPS PRO effects are favorable, even when compared with the savings attributed to state rate-setting programs.

The results, however, offer some surprises. While per capita cost was 3.7 percent lower, the result is driven entirely by a 5.3 percent reduction in per capita admissions. Cost per admission, in real terms, was unchanged. While length of stay declined 2.4 percent, cost per day increased by 2.8 percent. This suggests that the average case-mix complexity has increased and the less sick patients have been forgoing inpatient care.

In other work, we examined Commission on Professional and Hospital Activities patient-discharge abstract data from 501 hospitals in each of four years. Using the Medicare Case Mix Index, the CPHA Resource Need Index, and the proportion of patients with a Medicare Case Mix Index value of 3.0 or greater, we found that the average case mix complexity of hospitals increased after 1983.

Additionally, the percentage of Medicare patients likely to have very long stays (more than one standard deviation above the mean length of stay in 1980) increased between 1983 and 1985 (Sloan, Morrisey, and Valvona 1988a). This is consistent with evidence through

1984 reported by DesHarnais et al. (1987). Further, the percentage of patients admitted to an ICU was higher in 1985 than in either 1980 or 1983 (Sloan, Morrisey, and Valvona 1988b). Thus, it is clear that post-PPS Medicare hospital admissions are sicker.

We also found that there has been a significant increase in transfers to nursing homes and home health agencies (Morrisey, Sloan, and Valvona 1988a, 1988b) and a shorter non-ICU length of stay of Medicare patients (Sloan, Morrisey, and Valvona 1988b). Therefore, it is not really surprising that we found shorter stays, but with higher per diem cost and with no statistically significant change in cost per admission.

The truly surprising result is the marked reduction in admissions. As our theoretical discussion suggested, the incentive under PPS was to encourage discharge readmission schemes designed to allow multiple payments for patients with multiple problems. Our findings are consistent with a view that the reduction in admissions was caused by the PRO component of the Medicare cost-containment program. As we noted, the PROs were given responsibility to review readmissions for appropriateness and to reduce admissions that were unnecessary or treatable on an outpatient basis. In a generic sense this is consistent with the evaluations of rate-setting in New York. The New York program became effective after 1976 when the state added utilization limits to the payment system (Morrisey, Sloan, and Mitchell 1983).

Data from ProPAC suggest that the PROs made vigorous efforts to review admissions. Forty-five percent of Medicare discharges were reviewed in the first two years of PRO operation. In 1986, however, only 2.5 percent of all reviewed cases were denied. Approximately 1.6 percent of all readmissions were found to be the result of premature discharge from an earlier inpatient stay (Prospective Payment Assessment Commission 1987). The magnitude of our results suggests that the effect of the PROs may largely have been the result of hospital fears that claims would be denied rather than through actual denials.

Before our results should be accepted for policy purposes, a number of additional issues must be resolved. First, a number of other cost-containment measures began to be implemented in the period of 1984 to 1985. Could these programs, rather than the implementation of PPS and PROs, be responsible for the effects we observe? Second, what lessons do estimates of short-run impact suggest for the long

run? Third, what are the implications of these results for quality of care? Fourth, what are the long-run implications of our findings on nonlabor cost?

Other Cost-containment Programs

Although most observers of the health care scene would probably agree that PPS has been the single most dramatic cost-containment innovation since 1980, there have been others. First, the number of health maintenance organization enrollees has increased at a rate of 20 percent per annum in the last few years. By 1985, 7.9 percent of the American resident population was enrolled in such plans (InterStudy 1986). Second, there has been significant growth in preferred provider organizations (PPOs) (Rice, deLissovoy, and Ermann 1986). Third, there has been a rapid increase in sites that provide treatment alternatives to inpatient care; examples include surgicenters and free-standing ambulatory centers. Fourth, there has been some increase in the use of beneficiary cost sharing (Herzlinger and Schwartz 1985) and implemented utilization review requirements (Greenberg 1987) on the part of employers and private insurers. The increase in the patient cost-sharing obligation was modest, however. Deductibles in private plans offered by medium and large firms were less than 20 percent higher in real terms in 1985 than in 1981 and far less than the cost of a day in the hospital. The extent of coinsurance remained unchanged for hospital care, and the lifetime maximum benefit of such plans rose by more than 50 percent (calculated from Jensen, Morrisey, and Marcus 1987). Finally, public programs such as Medicaid have in some cases changed their payment policies (Guterman and Dobson 1986) or tightened eligibility and benefits (Intergovernmental Health Policy Project 1985).

We were able to address directly the first two of these factors, HMOs and PPOs, by including measures of their influence in our regressions. Thus, our PPS PRO findings are net of the influence of these competitive elements. Indeed, our results suggest that while higher HMO market share generally was associated with lower utilization and costs, the coefficients did not achieve statistical significance at the conventional levels. We measured the influence of PPOs by a binary variable taking the value "one" in California, Florida, and Colorado in 1985. (Rice, deLissovoy, and Ermann [1986] reported

that PPOs had 5.8 million eligibles in 1985, 65 percent of whom were in these three states.) The results suggest that PPOs did not yet exhibit any marked effect on hospital performance by 1985. We were able to control roughly for change in Medicaid benefits and eligibility in our regression analysis, since the variables representing the percentage of hospital revenues paid by each of the major payers were included as explanatory variables.

Data on the other cost-containment activities are not available by state and year for our period of analysis. Some, such as increased cost sharing, probably had a minimal influence as of 1985. But this practical limitation aside, it is important to ask whether one can examine the effects of these programs without at the same time considering PPS.

There are two reasons for believing that these factors are not independent of PPS. First, and most important, PPS undoubtedly stimulated much of the other activity. Implementation of PPS showed that the hospital industry will accept an alternative to cost-based reimbursement. It changed the relation between the hospital and its medical staff. It provided the impetus for improved monitoring of use of hospital services. It has forced other purchasers to act out of fear that they will become the victims of cost shifting from an effective PPS. The phasing-out of cost-based reimbursement allows parties on both the supply and demand side to think about a variety of other forms of payment, such as private contracting. The change in hospital/medical staff relations has led to a large set of questions about hospital admission and treatment patterns. The data collection systems developed in response to PPS can also be used by other utilization reviewers which by themselves may have been too small to encourage a sufficient amount of software development and related managerial expertise. Indeed, Jensen, Morrisey, and Marcus [1987] tracked employer activities to control health benefit costs between 1981 and 1985. They found that what changes have occurred, occurred between 1984 and 1985. Similarly, Gabel et al. [1987] found that insurer activities increased substantially after 1984. Much of the recent growth in out-of-hospital health care facilities may be attributed in large part to the changed incentives providers of inpatient care face under PPS. To the extent that many of the cost-containment activities are reactions to a changed environment stimulated by PPS, they cannot properly be considered to be exogenous influences.

The new "business-like" atmosphere promulgated by PPS has led to the provision of health care services in more cost-effective settings such as physicians offices, outpatient clinics, surgicenters, walk-in clinics, HMOs, and home health agencies (Waldo, Levit, and Lazenby 1986). The utilization of new technologies on an outpatient basis may have resulted in more sophisticated care being delivered at these settings. Such increased use of resources may make current methods of calculating "adjusted" admissions no longer accurate, resulting in an overestimate of PPS's effect on adjusted hospital admissions.

The second reason for doubting that these private-sector efforts had significant independent effects is that there is little rigorous evidence that pre-PPS private initiatives have been successful in reducing the rates of increase in health care costs. The record of nonstate-sponsored rate-setting, for example, has clearly been inferior to the mandatory state-run programs (Sloan 1983). While some localized experiments have been successful, it is difficult to attribute nationwide effects to these programs.

On the other hand, there is some evidence that effects independent of PPS may have contributed to the observed reductions. National community hospital admissions per capita have been declining since 1980 (computed from American Hospital Association 1986). The declines from 1980 to 1983, however, averaged 1.02 percent per year. The declines from 1983 to 1984 and 1984 to 1985 were 3.81 and 6.10 percent, respectively. Thus, there is a modest trend of reduction in per capita admissions prior to prospective payment that suggests that some unmeasured factors may be responsible for some small part of the Medicare cost-containment effect we report.

Short-run versus Long-run Effects

If we assume that our findings are the true, unbiased effects of PPS PROs, we can extrapolate the findings to a fully implemented program. If maintained, PPS PROs could reduce real per capita spending on care in community hospitals by about 20 percent. Of course, given two years of experience, projecting outcomes for a decade or more is highly speculative. In one sense, however, such an effect is believable. Individual HMOs are said to achieve cost savings of between 10 and 40 percent (Luft 1981). If so, such organizations might easily achieve

systemwide savings in the 20 percent range if they had Medicare's market share.

But there are other reasons to be more suspicious of the long-run estimate. For one, the estimated reduction in outlays for hospital care is largely, and from the regression analysis, completely attributable to a reduction in hospital admissions. Viewed narrowly, PPS contains no explicit incentives to reduce admissions. The program encourages admissions of relatively easy cases (within diagnosis-related group categories) and discourages cases that are relatively resource-intensive. If, indeed, the reduction in admission rates can be linked to PPS, it must be through the general questioning of hospital admission and treatment patterns that PPS engendered or, more likely, the fear of payment denial engendered by the PROs. It is quite possible that doctors will return to their admission practices, once the economic incentives under PPS were properly understood or the PROs are discovered to deny only occasional claims. If so, the savings would have to come from a reduction in cost per admission and/or lower profit margins. On the other hand, if, as some commentators report [*Hospitals* 1987a, 1987b], the second round of PRO contracts put in place in 1986 were more stringent than the earlier round, the reductions we find may be sustainable.

Implications of the Results for Quality of Care

Judging from our results on cost per adjusted admission and patient day, there is no reason to conclude that inpatients on the whole have been denied beneficial care that they would have received in the absence of recent Medicare hospital cost-containment initiatives. The regression results show no negative impacts on either cost measure. The descriptive evidence shows increases in real cost per adjusted admission and per patient day during the period of 1984 to 1985, albeit at a lower rate than previously. At least for the early years of PPS, it would be more useful to focus on the care received by persons who were not admitted.

Our own studies of individual patient data in 501 hospitals support this conclusion. We have found, for example, little evidence that PPS induced "dumping" of either Medicare or self-pay patients (Sloan, Morrisey, and Valvona 1988a). While the probability of a transfer to posthospital subacute care increased dramatically after 1983, there was no consistent pattern in the severity of illness in transferred

patients (Morrisey, Sloan, and Valvona 1988a). Further, we have found that while the use of both routine hospital services and some advanced diagnostic procedures have declined, the use of intensive care units has increased, and the length of stay in such units has remained stable (Sloan, Morrisey, and Valvona 1988b). Further, recent work by DesHarnais et al. (1987) suggests that, at least through 1984, there were no PPS-induced changes in consultation rates, inhospital deaths, or readmission rates.

Implications of Our Findings on Nonlabor Cost

Largely because of the large existing variation among hospitals in capital cost, Congress excluded capital cost from the Medicare prospective payment system. A system for paying for capital cost was to be developed later. With operating cost controlled, and capital cost—principally interest and depreciation—uncontrolled, one would expect hospitals to substitute buildings (i.e., labor-saving designs) and major equipment for labor, and, more generally, channel funds into capital projects. There are several indications that excluding capital cost from PPS has had the widely anticipated (at least within the academic community) but undesirable effect. Spending for major movable equipment, in particular, increased after 1983. If capital expenditures continued to be a cost pass-through, it is reasonable to expect this distortion to become even more evident in the future as hospitals have more time to adjust their mix of capital and labor to this set of incentives. If so, the long-run cost-containment effect of PPS could be undermined.

State versus Federal Cost-containment Efforts

A single payer, such as Medicare, is understandably more concerned about budgetary control of its own program and the welfare of its insured than it is about systemwide implications. Our previous study (Morrisey, Sloan, and Mitchell 1983) cast doubt on the cost-saving potential of waivers to allow states to include Medicare in their rate-setting programs. The main reason was that many other payers did not obtain the sizable discount Medicare obtained from hospitals. Hence, Medicare would have to "level up" before it "levelled down" if systemwide cost-containment effects are to be achieved by the state's

rate-setting program. The present study seriously questions whether the hospital systemwide effects of state mandatory rate-setting effects have been very large relative to Medicare's "go-it-alone" approach to hospital cost containment.

Cost Shifting

We argued that the philosophy underlying hospital cost containment in the 1980s has been that of self-interest. Each payer is to be concerned about its own costs; those that fail to do so aggressively deserve to be the victim of cost shifting. The results of the first two years of PPS suggest that rather than shift costs from one payer to another, PPS, in combination with PROs, has had the effect of reducing the rate of increase in health care costs per capita. Indeed, Zuckerman (1987), using different data, arrived at a similar conclusion.

There may be cost shifting to other sectors of the health economy, however. The national health care expenditures are rising more rapidly than in the recent past (Waldo, Levit, and Lazenby 1986). Evidence is beginning to emerge that costs are being shifted from the hospital sector to other health care sectors (Kramon 1988). This is consistent with our own studies of transfers to nursing homes (Morrisey, Sloan, and Valvona 1988b). A more direct analysis of the effects of PPS on nonhospital providers and ideally on aggregate health care costs is, however, certainly in order.

Conclusion

In sum, we find significant cost-reducing effects of recent Medicare hospital inpatient cost-containment efforts. These savings appear to have been generated almost entirely as a result of reduced admissions. There is no explicit financial incentive in PPS, however, to reduce admissions. Rather, such an incentive is found in the PRO program, which was made part of PPS and implemented almost simultaneously. The fundamental issue for future research is, then, the independent effects of PPS and the PROs—and the possibility that some unidentified third factor is driving the reduced admissions. To accomplish this, it will be necessary to monitor utilization-review activities directly.

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