LINKING MEDICARE CAPITAL PAYMENTS TO HOSPITAL OCCUPANCY RATES

by Michael Hemesath and Gregory C. Pope

Prologue: *How to reimburse hospitals for their capital costs has remained a thorn in the side of the Medicare prospective payment system since its enactment in 1983. Congress initially agreed to pay for the portion of "reasonable" capital costs attributable to a hospital's Medicare patients, while setting a deadline of October 1986 for devising a method of incorporating capital payment into the new system of prospectively determined per case payments (diagnosis-related groups, or DRGs). This deadline has been pushed back several times and now stands at October 1, 1991. In the meantime, capital payments to hospitals have been subjected to across-the-board reductions (15 percent in fiscal year 1989) as Congress and the adminstration strive to lower the federal budget deficit. In this paper, economists Michael Hemesath and Gregory Pope argue that this current method of saving money is "essentially arbitrary" and propose a means of cutting capital payments through occupancy penalties. They write: "A more equitable policy would link payment amounts to the degree of capacity utilization of particular facilities. Such a policy would encourage reductions in unused capacity while not penalizing heavily used facilities." Though most hospital groups decry such a linkage, Rep. Pete Stark (D-CA) and the Health Care Financing Administration have shown interest in relating occupancy measures to Medicare capital payment. Hemesath and Pope recognize that prospective payment of capital is preferable to occupancy penalties and offer this proposal as "an interim measure." Hemesath holds a doctorate in economics from Harvard University and was a senior economist with the Center for Health Economics Research (CHER) in Needham, Massachusetts and instructor at Tufts University at the time of this study. He is currently an assistant professor of economics at Carleton College in Northfield, Minnesota. Pope, a senior economist at CHER for the past five years, earned a master's degree in economics from the Massachusetts Institute of Technology.*

When Congress legislated the Medicare prospective payment system (PPS) in 1983 to control rising inpatient costs, hospital capital-related costs were excluded from the reform. Over five years later, despite proposals by the Health Care Financing Administration (HCFA) to incorporate all costs into PPS, capital costs are still reimbursed on the basis of reasonable cost. Further, passage of the Omnibus Budget Reconciliation Act (OBRA) of 1987 precludes prospective payment for capital-related costs until at least fiscal year 1992.[1]

Medicare's share of hospital capital costs is determined by its share of inpatient days. For instance, Medicare will pay half of a 100-bed hospital's capital costs even if only two beds were occupied all year, so long as one of those beds was occupied by a Medicare patient. Thus, Medicare capital costs are paid regardless of hospital occupancy.

PPS has decreased hospital length-of-stay and, in turn, has increased the level of excess capacity, as measured by empty beds. Many policymakers feel that much of Medicare's capital reimbursement is paying for excess inpatient capacity that is currently unused and not likely to be needed in the future. For this reason, Medicare capital payments are an attractive target for budgetary savings. Congress has enacted a series of across-the-board percentage reductions in Medicare capital payments. In fiscal year 1989, only 85 percent of Medicare's share of capital costs is reimbursed.

The current policy of percentage reductions is essentially arbitrary. The amount of the reduction is not explicitly related to the aggregate amount of excess capacity or to overspending. Hospitals that have been prudent in their investment decisions are penalized by the same percentage as their profligate peers. A more equitable policy would link payment amounts to the degree of capacity utilization of particular facilities. Such a policy would encourage reductions in unused capacity while not penalizing heavily used facilities.

The temporary prohibition on prospective payment for capital has led to interest in interim measures that can achieve budgetary savings in an equitable and efficient manner, while not threatening access to care. Linking capital payments to hospital occupancy rates is one alternative, which we explore in this article.[2] After presenting background information on trends in capital costs and occupancy, we describe and simulate a reimbursement formula in which a hospital's capital payments are reduced if the hospital falls below theoretically justified occupancy thresholds. An aggregate reduction of approximately 28 percent of Medicare capital costs can be justified on the basis of current occupancy rates. This represents a savings to Medicare of over one billion dollars compared to cost reimbursement. The aggregate 28 percent reduction is very close to

the 25 percent reduction the administration proposed in its fiscal year 1990 budget. However, unlike the administration's proposal, which would cut uniformly across hospitals, our proposal would achieve more savings from underused facilities.

Following discussion of implementation issues and potential hospital responses to occupancy penalties, we compare them to prospective reimbursement for capital. A hospital's capital costs per case can be excessive either because it has excess capacity or because it employs too much capital per bed. Occupancy penalties address only the former source of inefficiency. Prospective reimbursement gives hospitals incentives both for greater capacity utilization and for containing capital costs per bed. Although occupancy penalties may be preferred to uniform percentage reductions, they should be seen only as an interim step toward prospective capital reimbursement.

Trends In Capital Payments And Occupancy Rates

In its first years, PPS slowed the rate of growth in inpatient hospital costs.[3] However, the continued passthrough of Medicare capital costs has not encouraged hospitals to contain their capital spending. Indeed, with reimbursement for operating expenses limited by the prospective diagnosis-related group (DRG) rates, hospitals profit to the extent they can substitute capital expenses for operating expenses.

Capital payments. Total Medicare capital payments (excluding the originally PPS-waivered states of New York, New Jersey, Maryland, and Massachusetts) increased from $2.66 billion in the hospital fiscal year preceding PPS to $3.68 billion in hospitals' third fiscal year on PPS. This is a growth of 38.3 percent over the four-year period, or an average annual growth of 9.1 percent. During the same period, capital costs increased as a share of total patient costs, from 8.1 percent in the fiscal year preceding PPS to 10.1 percent in the third year of PPS (a 24.7 percent total increase).

Given the long lead time in building projects, some of the increased proportion of capital in total costs is due to capital spending committed prior to the implementation of PPS. Hospitals were able to reduce their rate of increase of operating expenses more quickly than their capital spending in response to PPS. Some capital spending is also due to the conversion of inpatient to outpatient services. Capital spending may moderate as hospitals have more time to adjust to PPS and lower inpatient utilization, but it does not seem to have been adequately contained thus far.

Occupancy rates. The rapid increases in capital costs are of concern given hospitals' low and declining inpatient census. Exhibit 1 displays

Exhibit 1
Average Hospital Occupancy Rates By Urban/Rural Bed-Size Group, TEFRA Through The Third Year Of PPS[a]

	TEFRA[b]	PPS1	PPS2	PPS3
National	56.9%	49.9%	46.9%	45.5%
Urban	63.6	57.0	54.0	53.4
Fewer than 100 beds	51.8	44.9	41.0	39.9
100-199 beds	61.9	54.8	51.7	51.2
200-299 beds	69.0	62.4	59.6	59.7
300-399 beds	71.6	65.2	63.0	62.7
Over 399 beds	75.5	69.9	67.6	67.6
Rural	50.8	43.3	40.3	38.5
Fewer than 25 beds	36.5	31.6	29.8	29.6
25-49 beds	44.3	37.7	34.9	33.0
50-99 beds	53.9	45.3	41.5	39.3
100-149 beds	62.3	52.9	49.5	48.0
Over 149 beds	67.4	59.1	56.1	54.6

Source: Medicare cost reports.
Note: The PPS-waivered states of New York, New Jersey, Massachusetts, and Maryland are excluded.
[a] Medicare's prospective payment system.
[b] Tax Equity and Fiscal Responsibility Act.

average hospital occupancy rates by hospital category for the fiscal year preceding PPS and the first three fiscal years of PPS. Since these tabulations are based on hospital fiscal year, there is some variation across hospitals in the actual starting time for each of the four years. Roughly, TEFRA corresponds to calendar years 1983-1984, PPS1 to 1984-1985, PPS2 to 1985-1986, and PPS3 to 1986-1987.[4]

By virtually any standard, occupancy rates were low throughout this four-year period. The average hospital occupancy rate nationally fell from 57 percent to 46 percent. The average rural hospital was half full in the year prior to PPS and less than half full thereafter. By the third year of PPS, the average urban hospital was only slightly more than half full. Reported occupancy may somewhat overstate empty beds because of lags in reporting conversion of inpatient beds to outpatient or other uses, or hospitals' desire to maintain licensed bed capacity. Nevertheless, these low occupancy rates suggest the presence of substantial excess capacity in the hospital sector.

Hospitals responded to PPS by sharply lowering their occupancy (by 7 percent, on average) in the first year. Occupancy continued to decline in subsequent years, although not as rapidly. By the third year of PPS, hospitals had not begun to rationalize their capacity in response to declining use. Generous capital reimbursement under Medicare may have contributed to hospitals' failure to reduce excess capacity. Average

occupancy varies substantially by hospital category (Exhibit 1). Two comparisons are especially noteworthy: rural hospitals were less full than urban hospitals, and small hospitals were less full than large hospitals.

'Ideal' Occupancy Rates

Hospitals cannot be expected to operate at 100 percent occupancy. Because illness or accidents are random, hospitals maintain reserve capacity. If a hospital is more full on average, it is more likely to turn away an emergency patient. The "ideal" or target occupancy rate for a hospital depends on the desired turnaway probability.[5]

A particular statistical distribution, the "Poisson," adequately describes the random nature of hospital admissions.[6] Using the Poisson model, the ideal occupancy rate can be calculated as a function of two variables: the probability of patient turnaways and hospital bed size. Exhibit 2 displays the ideal occupancy rates for different hospital sizes (25–500 beds) and two turnaway probabilities (one and ten patients turned away per 1,000 patient days).[7] The ideal occupancy rate rises rapidly at small bed sizes but changes much more slowly as hospital size grows larger. It is not greatly sensitive to the difference in turnaway probabilities, particularly at larger bed sizes.

Ideal occupancy rates provide a basis for judging whether a hospital has excess capacity. If the Medicare program wants to pay only for justified capacity, an occupancy-adjusted capital reimbursement can be calculated by comparing the hospital's actual occupancy rate to the threshold occupancy rate for that size hospital:

$$\text{Medicare capital costs} \times \frac{\text{Actual occupancy rate}}{\text{Threshold "ideal" occupancy rate}} = \text{Adjusted capital payment}$$

(Maximum allowed value = 1)

Note that a hospital achieving an occupancy rate greater than the threshold occupancy rate would receive full reimbursement of costs.

This calculation embodies several assumptions that could be modified in a more refined occupancy adjustment. First, the occupancy penalty is directly proportional to the amount of excess capacity. For example, if the threshold occupancy were 70 percent, a hospital that had an occupancy rate of 50 percent would find its penalty twice as large as that of a hospital with a 60 percent occupancy rate, if Medicare capital costs were the same at the two hospitals. However, the costs of excess capacity are not proportional to the level of excess capacity if hospitals provide movable equipment only for utilized capacity, or if hospital construction

Exhibit 2
"Ideal" Occupancy Rates By Hospital Bed Size

	Number of turnaways per 1,000 patient days	
Hospital bed size	One	Ten
25	55%	63%
50	65	72
75	70	77
100	74	79
150	78	83
200	81	85
250	82	86
300	84	87
400	86	89
500	87	90

Source: Calculated based on Poisson model of hospital admissions.

costs are not proportional to the number of beds. In the former case, one should apply the occupancy penalty only to beds and fixed equipment costs.[8] In the latter case, a nonproportional penalty is appropriate.

Second, a single desired turnaway probability is used for all hospitals. In a refined occupancy adjustment, turnaway standards and ideal occupancy rates would vary based on the distance and capacity of a hospital's neighbors.[9] For example, isolated rural hospitals would have a lower threshold occupancy rate than urban hospitals because turnaways from the former are more serious. The turnaway probability also should be lower for hospitals serving a higher proportion of emergency patients.

Third, the penalty is based on average annual occupancy rates. Systematically higher utilization at certain times—for example, in rural hospitals in the winter months—is not taken into account. If such "peak load" issues are important, the occupancy penalty could be based on a hospital's highest-occupancy month rather than its annual average. Finally, since the penalty is based on total hospital occupancy, all hospital beds are implicitly considered fully substitutable. If some beds cannot be easily converted to other uses, they could be excluded from the computation of the penalty.

Simulation Of Occupancy Penalties

We simulated occupancy-adjusted Medicare hospital capital payments with Medicare cost report data from the third fiscal year of PPS. The simulations use a desired maximum turnaway of one patient per 1,000 patient days to calculate the threshold ideal occupancy rate.[10] This

turnaway rate is generally considered to be a low probability.[11] The simulations assume no hospital response to occupancy penalties, an important point to which we return later.

Adjusting Medicare capital reimbursement using occupancy thresholds would lead to substantial program savings relative to a cost pass-through.[12] In the third year of PPS (when capital costs were still fully reimbursed), hospital capital payments would have been reduced by $1.04 billion, excluding the four PPS-waivered states. This represented 28.2 percent of total Medicare capital payments. Fiscal year 1990 savings would be considerably larger because of inflation, real increases in hospital capital spending, and the incorporation of New York and Massachusetts hospitals into PPS. The occupancy adjustment would have reduced payments to over 96 percent of all PPS-eligible hospitals in the third year of PPS, an indication of how underused the inpatient wards of most American hospitals are.

These savings can be compared to the administration's fiscal year 1990 proposal of a 25 percent across-the-board reduction in capital payments. Across-the-board cuts would have saved $922 million in the third year of PPS and would have affected all hospitals. While either policy of reducing capital reimbursements would save Medicare similar amounts of money, the distributional consequences of the two policies are different.

Occupancy penalties would reduce reimbursement proportionately more in hospitals with lower capacity utilization relative to their threshold occupancy (Exhibit 3). The average urban hospital would lose 26.6 percent of its reimbursement; the average rural hospital, 34.4 percent. Larger hospitals would fare better than smaller ones, voluntary better than proprietary and public, and teaching better than nonteaching.

Payment reductions under occupancy penalties would range considerably from 72.5 percent for hospitals in the top 5 percent to 2.9 percent cuts for the bottom 5 percent. The median hospital's Medicare capital costs would be cut by 38.1 percent. The most affected 10 percent of hospitals would lose 65.4 percent or more of their costs, while the least affected 10 percent of hospitals would lose only 9.6 percent or less.

Because of their low utilization, rural and small urban hospitals contribute a disproportionate share of total occupancy penalty savings, relative to their share of capital costs (Exhibit 4). For example, rural hospitals with more than twenty-five and fewer than fifty beds incurred 2.5 percent of total capital costs but contributed 3.5 percent of the total program savings under the occupancy thresholds. The relatively large impact on small and rural hospitals is of concern because these hospitals are in the worst financial condition.[13] An occupancy adjustment that makes these hospitals' financial situations even more precarious could

Exhibit 3
Average Occupancy Penalty As A Percentage Of Total Medicare Capital Costs, By Hospital Characteristic

National	30.7%
Urban	26.6
Fewer than 100 beds	35.0
100–199 beds	31.1
200–299 beds	26.3
300–399 beds	26.7
Over 399 beds	22.1
Rural	34.4
Fewer than 25 beds	38.8
25–49 beds	39.6
50–99 beds	38.9
100–149 beds	34.7
Over 149 beds	29.1
Ownership	
Voluntary	25.3
Proprietary	38.9
Public	30.5
Medicare type	
Sole community provider	34.4
Rural referral	24.6
Other rural	37.6
Teaching status	
Nonteaching	32.3
Minor teaching	22.4
Major teaching	13.4

Source: Medicare cost reports for the third year of PPS.
Note: The PPS-waivered states of New York, New Jersey, Massachusetts, and Maryland are excluded.

cause them to close and could affect access to hospital care for certain beneficiaries, particularly in rural areas.

However, small and rural hospitals could be exempted from occupancy penalties while retaining most of the overall program savings. Two-thirds of the total savings come from urban hospitals of 100 beds or more (Exhibit 4). If only rural hospitals of under 150 beds were exempted, 83 percent of total savings could be retained while sparing those hospitals that are in the greatest financial jeopardy and that are probably the most valuable in ensuring access. Medicare's classification of "sole community provider" hospitals could serve as the basis for an exemption because these isolated rural hospitals are important in ensuring access to care.

Implementation And Hospital Response To Occupancy Penalties

The simulations reveal how occupancy adjustments would have affected hospitals and Medicare capital reimbursement, assuming no re-

Exhibit 4
Sources Of Occupancy Penalty Savings Compared To Sources Of Capital Costs, By Hospital Characteristic

	Percent of total Medicare capital costs	Percent of total savings
Urban		
Fewer than 100 beds	5.2%	6.5%
100-199 beds	16.3	18.0
200-299 beds	19.6	18.2
300-399 beds	14.1	13.3
Over 399 beds	24.6	19.4
Rural		
Fewer than 25 beds	0.3	0.4
25-49 beds	2.5	3.5
50-99 beds	5.5	7.6
100-149 beds	4.5	5.5
Over 149 beds	7.5	7.7

Source: Medicare cost reports for the third year of PPS.
Note: The PPS-waivered states of New York, New Jersey, Massachusetts, and Maryland are excluded.

sponse on the part of hospitals. In reality, occupancy penalties would create incentives that are likely to change hospital behavior. Hospitals would attempt to lessen occupancy penalties either through changes in the reporting of their occupancy rates or through real changes in available beds, staffing, admissions, length-of-stay, or capital stock. These responses would reduce program savings from occupancy penalties, perhaps significantly, especially over the long term. However, converting underused capacity to productive uses would raise the efficiency of the hospital industry.

Occupancy rates are defined as the number of inpatient days divided by the total number of inpatient bed-days available. Inpatient days are straightforward to define and measure and are subject to little gaming. In contrast, the total number of inpatient bed-days available can be defined in at least two ways, both imperfect. One measure includes all licensed acute care beds, the other is limited to all staffed beds.[14] Licensed beds are those beds authorized by a state or local licensing board. Staffed beds are those beds set up and staffed for use by patients during a given time period.[15]

Staffed beds versus licensed beds. The number of licensed beds available in a hospital provides an upper limit to the number of patients that may be served, but it may have little to do with the hospital's current capacity. The number of licensed beds may reflect an earlier period in the hospital's history, or it may represent a target for future growth. Moreover, licensing standards and procedures vary from state to state. Since staffed beds cannot exceed licensed beds, basing an occupancy adjust-

ment on licensed beds will lead to larger penalties.

Currently, a hospital has incentives to keep its number of staffed beds as low as possible. First, staffed beds contribute to variable costs. Second, staffed beds are already used in the PPS payment for indirect medical education that is based on the number of interns and residents per bed (although most hospitals do not receive indirect medical education payments). Occupancy penalties, however, would greatly increase the incentive for a hospital to raise its occupancy rate by underreporting its staffed beds. The incentive would be especially strong for rural and small hospitals for which the occupancy adjustment might represent a real financial hardship. The effectiveness of an occupancy adjustment in this case would depend on the ability of Medicare's fiscal intermediaries to monitor the number of staffed beds in a hospital. Thus, for ease and cost of administering an occupancy adjustment program, licensed bed capacity is preferable to staffed beds as a measure of total capacity that generates fixed capital costs, even if some of that capacity is not currently staffed.[16]

Hospital responses. In addition to changing their reported occupancy rate, hospitals may make real behavioral modifications in response to the imposition of occupancy penalties. In the short run, roughly a period of under a year, the hospital has four possible responses to a binding occupancy adjustment.[17]

First, the hospital could try to increase its admissions to raise its occupancy rate by inducing more demand for its services or by attracting patients from competing hospitals. Since the hospital already has an incentive to fill any of its empty beds if it can do so profitably, it is not likely that the additional gains from admissions created by an occupancy penalty would have a large impact on hospital behavior.

Second, the hospital could respond by increasing its average length-of-stay, again to raise its occupancy rate. This behavior would be at odds with the incentives of the per case PPS rates, which encourage shorter lengths-of-stay. The hospital would have to compare the marginal benefit of the higher capital reimbursement to the marginal cost of the increased length-of-stay.[18]

Third, the hospital could decrease its number of beds. If the threshold occupancy rate is based on staffed beds, this number could be subject to manipulation, as discussed above. If licensed beds are used, delicensing would be necessary to increase occupancy rates without increasing patient days. However, if the hospital wishes to maintain flexibility in responding to increases in the demand for its admissions, it might be unwilling to delicense beds.

A fourth response is to do nothing, to simply accept the smaller

Medicare reimbursement for capital-related costs.

The most likely hospital response to an occupancy adjustment in the short run is to decrease the number of staffed or licensed beds, thereby increasing the occupancy rate, lowering the ideal occupancy threshold, and reducing the occupancy penalty. If the resulting capacity is converted to other Medicare-covered services such as outpatient care, total Medicare capital reimbursement might not be reduced. If some portions of the hospital were actually closed, to avoid paying for excess capacity, Medicare would have to disallow capital costs associated with portions of hospitals not used for patient care. The administrative cost and complexity of accurately measuring hospital inpatient capacity utilization are significant, although not insuperable, drawbacks to occupancy penalties. In contrast, uniform percentage reductions in capital payments are easy to administer and are not subject to gaming.

In the long run, after the occupancy adjustment has been in place one year, it should begin affecting the capital investments of the hospital. The occupancy adjustment will raise the implicit cost of capital for all hospitals whose occupancy rate falls below the threshold occupancy rate, thus discouraging capital investment and replacement of current capital. Hospitals affected by the occupancy adjustment will shrink to a more efficient size as they are discouraged from replacing their capital. As the number of beds falls, the occupancy rate will rise until the hospital is no longer affected by the occupancy adjustment. At this time the hospital should have a capital stock that is commensurate with its patient load.

While an occupancy adjustment establishes incentives for an efficient level of capacity in the long run, the hospital with an occupancy rate above the threshold has no incentive to restrain capital spending. In other words, an occupancy adjustment penalizes excess capacity but not excessive provision of capital per bed. Only prospective capital reimbursement—a fixed per case payment based on efficient capital costs—establishes incentives both to tailor capacity to utilization and to contain spending per bed. Further, only prospective reimbursement gives Medicare control over capital outlays per discharge and encourages use of the cost-minimizing mix of capital and operating inputs. Since low-occupancy hospitals (for example, rural and small hospitals) tend to have low capital spending per case, occupancy penalties could penalize the hospitals that are most parsimonious in their use of capital and might fare best under prospective reimbursement.[19] Finally, prospective capital payment is much less administratively burdensome than occupancy adjustments. Thus, occupancy penalties should be seen only as an interim measure that can achieve program savings and encourage reduction of unneeded capacity until prospective capital reimbursement is enacted.[20]

This research was supported by the Health Care Financing Administration (HCFA) through Cooperative Agreement no. 18-C-98526/1-05 to the Health Policy Research Consortium (Brandeis University, Boston University, The Center for Health Economics Research, and the Urban Institute). We thank Jerry Cromwell, two anonymous reviewers, and our HCFA project officers Fred Thomas and Mark Wynn for helpful comments. However, the views expressed herein are solely the authors'. No endorsement by the funding agency is intended or should be inferred.

NOTES

1. For background on capital payment policy through September 1987, see *Federal Register* 52, no. 169 (1 September 1987): 33168–33179.
2. For an alternative analysis of linking capital payments to occupancy rates, see Prospective Payment Assessment Commission, *Linking Medicare Capital Payments to Hospital Occupancy Rates: Report to Congress* (Washington, D.C.: ProPAC, 29 April 1988).
3. See Prospective Payment Assessment Commission, *Medicare Prospective Payment and the American Health Care System: Report to Congress* (Washington, D.C.: ProPAC, February 1987 and June 1988).
4. TEFRA refers to the Tax Equity and Fiscal Responsibility Act of 1982.
5. For a discussion of ideal occupancy rates, see W. Shonick, "Understanding the Nature of Random Fluctuations of the Hospital Daily Census: An Important Health Planning Tool," *Medical Care* (March/April 1972): 118–142; and W. McClure, *Reducing Excess Hospital Capacity* (Excelsior, Minn.: InterStudy, 1976).
6. W. Shonick, "A Stochastic Model for Occupancy-Related Random Variables in General Acute Hospitals," *Journal of the American Statistical Association* 65 (1970): 1474–1500.
7. The "ideal" occupancy rate is calculated as a function of the probability of patient turnaways, assuming that patients arrive at a hospital according to a Poisson process with mean equal to the hospital's average daily census (ADC). Define: Z = (S−ADC)/root(ADC), where S = hospital bed size. The probability of patient turnaways is associated with the Z statistic, which can be approximated by a standard normal distribution. See P. Joskow, "The Effects of Competition and Regulation on Hospital Bed Supply and the Reservation Quality of the Hospital," *Bell Journal of Economics* 11, no. 2 (Autumn 1980): 421–447.

   The expression for Z can be solved for ADC: ADC = {(−Z + root(Z/2 + 4 × S))/2}/2. The ideal occupancy rate is then: Ideal = ADC/S. If a hospital with S beds maintains an occupancy rate of ADC/S, the turnaway probability is the probability associated with the Z statistic.
8. Savings from occupancy penalties applied only to "routine" capital, which is closely related to the cost of beds, are about 60 percent of the savings from the penalty applied to both routine and ancillary capital.
9. For a discussion of travel costs, see P. Feldstein, *Health Care Economics* (New York: John Wiley and Sons, 1979), 220–223.
10. The analysis uses ten hospital groups based on rural/urban location and bed size. Using the Poisson model of hospital admissions with a one in a thousand turnaway rate, the following threshold ideal occupancy rates can be calculated for each of the ten peer groups: rural fewer than 25 beds is 50 percent; rural 25–49 beds, 60 percent; rural 50–99 beds, 70 percent; rural 100–150 beds, 77 percent; rural more than 150 beds, 81 percent; urban fewer than 100 beds, 70 percent; urban 100–199 beds, 78 percent; urban 200–299 beds, 82 percent; urban 300–399 beds, 85 percent; and urban more than 400 beds, 87 percent.

11. The "optimal" turnaway probability depends on the cost of hospital capacity and the value to the marginal patient of being admitted rather than turned away. Joskow, "Effects of Competition and Regulation."
12. Because data were unavailable for the four PPS-waivered states, Massachusetts, New York, New Jersey, and Maryland, all calculations pertain only to the nonwaivered states. For the third year of PPS, Medicare cost report data were available for approximately 3,800 hospitals at the time of this analysis. An assumption (based on American Hospital Association counts) of 5,200 total Medicare-eligible hospitals in the nonwaivered states was made to extrapolate simulation results to the universe of all Medicare-eligible hospitals in these states.
13. See S. Guterman et al., "The First Three Years of Medicare Prospective Payment: An Overview," *Health Care Financing Review* 9, no. 3 (1988): 67–77.
14. The occupancy rates used in the simulations described above are based on staffed beds. Licensed beds are not available on the Medicare cost reports. Using licensed beds would increase the aggregate amount of the occupancy penalties.
15. The hospital would also plan for standby capacity so that not every bed would be filled.
16. Staffed beds and licensed beds were closely related during the four years under consideration in this article. In the TEFRA year, the ratio of Medicare cost reports staffed beds to licensed beds from the American Hospital Association Annual Survey was .94. In the first year of PPS this ratio climbed to .97 and remained there in the second and third years of PPS. This close relationship might not be maintained in the face of an occupancy adjustment.
17. If an occupancy penalty is not binding, meaning that the hospital occupancy rate exceeds the threshold level, it is assumed that the hospital will not alter its behavior since it receives the full reasonable cost reimbursement for its capital-related costs.
18. The marginal benefit of an additional patient day can be calculated as follows. The adjusted Medicare capital payment for a 100-bed hospital with a 50 percent occupancy rate, subject to an occupancy threshold of 70 percent, is: .5/.7 × current Medicare capital payment (approximately $500,000 on average for a 100-bed hospital in PPS3) = $357,143. Adding one more patient day brings the average occupancy rate to 50.0027 percent (18,251 patient days/36,500 total patient days). The adjusted Medicare capital reimbursement with one additional patient day is: .500027/.7 × current payment of $500,000 = $357,162. The marginal benefit of an additional patient day is $19 in this case. For a wide range of possible hospital sizes and occupancy adjustments, it can be shown the marginal benefit remains well under $50, which is likely to be much lower than the marginal cost of an additional day. Thus, it does not appear profitable to increase length-of-stay to reduce an occupancy penalty.
19. See ProPAC, *Linking Medicare Capital Payments to Hospital Occupancy Rates.*
20. For an analysis of paying for capital prospectively, see Congressional Budget Office, "Including Capital Expenses in the Prospective Payment System" (Washington, D.C.: CBO, August 1988); and General Accounting Office, "Medicare: Alternatives for Paying Hospital Capital Costs" Pub. no. HRD-86-93 (Washington, D.C.: GAO, August 1986).