ONLINE APPENDIXES 3

Hospital inpatient and outpatient services

ONLINE APPENDIX 3–A

When volume declines, what happens to cost per discharge?

The prevailing view among physicians and hospital administrators is that the majority of hospital costs are fixed in the "short run." The variation in hospital occupancy rates and the decline in inpatient volume observed over the last seven years creates an opportunity to test how much of hospital costs per discharge are fixed over a one-year planning horizon. If the vast majority of hospital costs are fixed, a 1 percent annual decline in volume would increase hospitals' rate of cost growth by almost 1 percent (after adjusting for input prices and other factors). However, if most costs vary with volume, a 1 percent decline in volume would have only a small effect on costs per discharge, all else equal. The degree to which hospital costs are fixed is an important question for the financial health of the hospital industry and a question that has implications for accountable care organizations (ACOs). Hospitals will be more likely to embrace the ACO model if their costs can be reduced (and relatively quickly) as unnecessary volume declines. In contrast, if most hospital costs are fixed, it would be harder to make the ACO model economically viable for hospital-based ACOs.

Historically, assumptions vary about what costs are fixed in the "short run"

Two definitional issues stem from the assertion that costs are largely fixed over the short run: What does *fixed* mean, and what does the *short run* mean? We contend that costs are not fixed if evidence exists that they vary with volume, and we define the short run as one year.[1] Under these definitions, the policy question becomes whether hospitals that forecast declines in volume because of changing financial incentives or practice patterns can adjust their cost structure within one year to match the lower volume.

Reducing costs can involve wage freezes, reduced hiring, or even layoffs. Given the unpleasant nature of downsizing, hospital administrators, financial officers, and consultants have a strong incentive to believe that most hospital costs are fixed, which can lead to the assumption that there is little cost in growing volume and little benefit in reducing volume. For example, a study from 15 years ago assumed that 84 percent of costs (including all labor costs) were fixed; it concluded that efforts to reduce volume would not significantly reduce the cost of hospital care (Roberts et al. 1999). A more recent study that has received significant press attention assumed 35 percent to 40 percent of hospital costs are fixed in the short run (Eappen et al. 2013). This assumption, coupled with misunderstandings about how often a single surgical complication results in a higher diagnosis related group weight, led the authors to conclude that hospitals have a financial disincentive to reduce complications, including infections. The data in Table 3A-1 (p. 4) suggest that hospitals have a greater ability to adjust costs according to volume than is assumed by much of the hospital industry. We find that Medicare's implicit assumption (used for outlier payments) that 20 percent of costs are fixed is a reasonable approximation.[2]

The correlation between occupancy and cost per discharge is small

Low-occupancy hospitals (average occupancy of 33 percent) had a standardized cost per discharge of $12,000 in 2012 (Table 3A-1).[3] High-occupancy hospitals (average occupancy of 73 percent) had standardized cost per discharge of $11,560. The 40 percentage point difference in occupancy was associated only with a 4 percent difference in costs (Table 3A-1, p. 4). This association tells us that, over the long run, as occupancy falls, costs per discharge increase, but the magnitude of the increase is small. We should not expect a big increase in costs as occupancy declines, and we should not expect a big decrease in costs if hospitals close and excess capacity is removed from the market because capital costs (buildings and equipment) are only 7 percent of a hospital's total costs.

Changes in inpatient volume have a small effect on cost per discharge

To test the share of hospital costs that are fixed over a one-year period (2011 to 2012), we modeled the relationship between changes in discharges and changes in costs per discharge.[4] The results for hospitals with over 2,000 discharges are shown in Table 3A-2 (p. 5). The 137 hospitals that had a decline in discharges of more than 10 percent (–16 percent on average, column 1) had cost growth that was 3.6 percentage points (i.e., 4.3 – 0.7) higher than hospitals that had more than a 10 percent increase in discharges (20 percent on average, column 3). The 36 percentage point difference in discharge growth was associated with a 3.6 percent difference in cost growth per discharge, which implies that about 10 percent of

TABLE 3–A1

Little long-run correlation between occupancy and cost per discharge

	Hospital occupancy level in 2012				
	Low: Less than 40 percent	**40 to 49 percent**	**50 to 65 percent**	**High: Over 65 percent**	**Over 80 percent**
Number of hospitals	424	416	787	560	85
Number of discharges					
Average	4,000	7,000	13,000	21,000	25,000
Minimum	2,000	2,000	2,000	2,000	3,000
Maximum	29,000	30,000	63,000	128,000	97,000
Average occupancy	33%	45%	57%	73%	85%
Standardized:					
Cost per discharge	$12,000	$12,030	$11,840	$11,560	$11,500
Costs relative to lowest occupancy category	Reference category	Equal	1% lower	4% lower	4% lower*
Overall Medicare margin	–9%	–8%	–7%	–5%	–3%*

Note: Standardized costs adjust for wage indexes, discharge mix, outliers, and interest costs.
*Standardized costs are only 4 percent lower, but margins are 6 percent higher for the hospitals with 85 percent occupancy because of other factors such as teaching payments and disproportionate share payments that affect the margins. Critical access hospitals are excluded from this analysis.

Source: MedPAC analysis of Medicare cost report data for hospitals with at least 2,000 discharges. Below this level, there may be some economy of scale issues.

hospital inpatient costs at hospitals in this sample are fixed over the period of one year. This percentage is slightly lower than earlier studies using data from the 1980s that implied that roughly between 10 percent and 30 percent of costs are fixed (Gaynor and Anderson 1995, Pauly and Wilson 1986). Another study, similar to the work in this chapter, concluded that most emergency department visit costs are variable over a reasonable planning horizon, which is also counter to conventional wisdom (Bamezai and Melnick 2006).

As a robustness check on our analysis, we can also examine the relationship between total hospital revenue (inpatient, outpatient, and all other sources) and total costs. Total revenue is a noisier variable in that it can be affected by payer mix and other sources of revenue, but it will still be useful as an indicator of how costs can change with revenue. The hospitals that faced a more than 10 percent decline in discharges had an 8.1 percent reduction in total revenue and a 4 percent reduction in total costs. The hospitals that had more than a 10 percent increase in discharges had an 11.4 percent increase in revenue and a 9.5 percent increase in costs. The 19.5 percentage point difference in revenue between the two groups was associated with a 13.5 percentage point difference in costs, suggesting that roughly 70 percent of decreases in revenue (13.5 / 19.5) were adjusted for by reducing cost growth over a one-year period. This method suggests that roughly 30 percent of costs are fixed. Taken together, the data suggest that for hospitals with more than 2,000 discharges, the vast majority of costs can be adjusted when volume declines and financial pressure to reduce costs increases.[5] Given our findings and those in the literature, the current assumption used in Medicare outlier payment policy, that 20 percent of costs are fixed, appears to be a reasonable approximation.

We conducted a sensitivity analysis and found that the results in Table 3A-1 were similar when we used different periods, high-margin hospitals, low-margin hospitals, or a combined inpatient/outpatient measure of output. The exception is that an analysis of small hospitals suggests that higher shares of their costs are fixed. If we limit the sample to hospitals with between 500 and 2,000 discharges per year, we find that the 63 small hospitals that experienced a decline in discharges of more than 10

TABLE 3–A2

Similar rates of cost growth based on volume changes

Characteristics	Change in all-payer discharges from 2011 to 2012: Reduction of over 10 percent	10 percent to –10 percent change	Increase of over 10 percent
Number of hospitals	137	1,783	111
Average all-payer discharges, 2011	8,308	12,808	8,788
Occupancy rate, 2011	50.1%	56.8%	50.9%
Average all-payer discharges, 2012	7,006	12,712	10,449
Occupancy rate, 2012	44.0%	55.5%	53.5%
Change in discharges	–16.0%	–1.0%	20.0%
Change in total revenue	–8.1%	2.6%	11.4%
Change in total costs	–4.0%	2.4%	9.5%
Standardized cost per discharge, 2011	$11,454	$11,535	$11,467
Standardized cost per discharge, 2012	$12,045	$11,861	$11,635
Mean change in standardized costs per discharge, 2011–2012	4.3%	1.9%	0.7%

Note: The sample of hospitals with a loss in discharges is limited to hospitals that also had a loss in total revenue, and the sample with a gain in discharges is limited to a set of hospitals with a gain in revenue. This sampling method is meant to keep shifts in outpatient revenue from offsetting shifts in discharges. Standardized costs per discharge are adjusted for discharge mix, wage rates, teaching costs, and outliers (see endnote 3).

Source: MedPAC analysis of 2011 and 2012 Medicare cost reports and claims files for hospitals with more than 2,000 discharges.

percent from 2011 to 2012 (–20 percent on average) had growth in standardized cost per discharge at a rate that was more than 9 percentage points faster than the 184 small hospitals that had no significant change in discharges (–1 percentage point).[6] This finding suggests that roughly 50 percent of small hospitals' costs are fixed over a one-year period. There are at least two reasons why a larger share of small hospitals' costs are fixed. First, small hospitals have low occupancy rates (28 percent on average), which means more beds (a fixed cost) per discharge. Second, small hospitals may have a more difficult time reducing staff costs or equipment costs as volume declines. For example, a small hospital may have only one pharmacist or one RN on the night shift. ■

Endnotes

1 Economists may think of the short run as the time before volume changes are known and can be planned for. In this paper, we use a more concrete term referring to a set period.

2 Medicare makes "outlier payments" for discharges with costs that greatly exceed prospective payment rates. After a hospital experiences a loss on an individual discharge above a fixed threshold, Medicare pays a "marginal cost factor" equal to 80 percent of costs above the threshold. This amount is based on an assumption that 20 percent of costs are fixed and 80 percent are variable. At the start of the Medicare program, there was a debate about how large the marginal cost factor should be, with estimates ranging from 85 percent to well below 60 percent (Health Care Financing Administration 1984). The marginal cost factor for Medicare started at 60 percent in 1984 and then was moved to 80 percent in fiscal year 1989 after some of the economics literature suggested that less than 20 percent of hospital costs were fixed over a reasonable planning horizon (Health Care Financing Administration 1988, Pauly and Wilson 1986).

3 To compute standardized costs per transfer-adjusted discharge, we start with total inpatient operating and capital costs allocated to Medicare inpatient discharges. We then adjust these costs for hospital-specific differences in wage rates using an index developed by the Commission, case mix using Medicare severity–diagnosis related groups, outlier costs, the cost of teaching, and the additional costs of treating low-income Medicare beneficiaries.

4 Because outpatient services could offset some discharge declines, we also created a measure that combines inpatient and outpatient volume called "adjusted discharges" and examined the relationship between total volume and cost per case mix–adjusted discharge. The results were similar.

5 Given the significant literature on the relationship between volume and outcomes, we examined whether the one-year change had a statistically significant effect on all-condition mortality using the methods described earlier in this chapter. We did not find a statistically significant change in risk-adjusted mortality, but it remains possible that consolidation of some services into higher volume centers could also improve outcomes.

6 We did not examine hospitals with fewer than 500 discharges because these hospitals will face long-term issues regarding economy of scale, as we have discussed in the past (Medicare Payment Advisory Commission 2001).

References

Bamezai, A., and G. Melnick. 2006. Marginal cost of emergency department outpatient visits: An update using California data. *Medical Care* 44, no. 9 (September): 835–841.

Eappen, S., B. H. Lane, B. Rosenberg, et al. 2013. Relationship between occurrence of surgical complications and hospital finances. *Journal of the American Medical Association* 309, no. 15 (April 17): 1599–1606.

Gaynor, M., and G. F. Anderson. 1995. Uncertain demand, the structure of hospital costs, and the cost of empty hospital beds. *Journal of Health Economics* 14, no. 3 (August): 291–317.

Health Care Financing Administration, Department of Health and Human Services. 1988. Medicare program; hospital inpatient prospective payment systems and fiscal year 1989 rates. Final rule. *Federal Register* 53, no. 1290 (September 30): 38502.

Health Care Financing Administration, Department of Health and Human Services. 1984. Medicare program; prospective payment for Medicare inpatient hospital services. Final rule. *Federal Register* 49, no. 1 (January 3): 266.

Medicare Payment Advisory Commission. 2001. *Report to the Congress: Medicare in rural America.* Washington, DC: MedPAC.

Pauly, M. V., and P. Wilson. 1986. Hospital output forecasts and the cost of empty hospital beds. *Health Services Research* 21, no. 3 (August): 403–428.

Roberts, R. R., P. W. Frutos, G. G. Ciavarella, et al. 1999. Distribution of variable vs fixed costs of hospital care. *Journal of the American Medical Association* 281, no. 7 (February 17): 644–649.