

Empiric Examination of Physician Behavior in a Changing Healthcare Market

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Abstract

We hypothesized that, in the current healthcare environment, medical providers have strong economic incentives to introduce new technology and treat patients more extensively. We examined physician reimbursement for medical procedures in Utah in the early 1990s, a period of increasing utilization of managed care methods, using a cross-section time series and a supply side model to analyze how physician behavior changed during this period of time. Our findings suggest that physicians have acted to maintain their revenue by requesting reimbursement for more procedures as the reimbursement level per procedure decreased. We conclude that increased volatility in reimbursement levels and increased adjudication pressure from payers provide signals to physicians to act strategically to protect their revenue stream.

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Traditionally, healthcare services have been priced on a cost-plus or fee-for-service basis. On the whole, cost has been defined as the usual and customary charges levied by healthcare providers (eg, hospitals, surgeons, and equipment manufacturers) for a particular geographic region. The final price providers extend to payers (ie, insurers, employers, and patients themselves) is a function of the payer's size or market presence and the variance in the reimbursement level. In determining their final price or fee, physicians exhibit price-discriminating behavior resulting from the inelastic demand for medical care and the asymmetry of information between providers and patients.¹

Economic theory suggests that the more successful the physician becomes in price discriminating among patients the greater the loss of consumer surplus, with the rents accruing to the physician. Payers, as agents for patients, have responded by implementing cost-containment measures intended to change the pricing strategy of healthcare providers. The cost-containment measures payers have been implementing raise philosophical, ethical, and political issues beyond the scope of our study.²

Cost-containment measures vary depending on the type of payer. Traditional payers (insurance companies and self-insured employers) have imposed such cost measures as requesting second opinions for surgical procedures, requiring discounts from contracted medical providers, and limiting the proliferation or growth in the use of technology. In the 1980s, the most common method was freezing or severely limiting increases in fees reimbursed to providers over the years. Under the Medicare Fee Schedule, which incorporated this method of controlling costs, physician revenue declined. However, because of increased service volume and complexity, physicians recovered about one half of the lost revenue.³

Since these measures have largely failed to contain the growth in healthcare costs, many payers have become quick to adopt capitation as a payment modality for healthcare services to medical providers. This has quickly become the preferred approach.

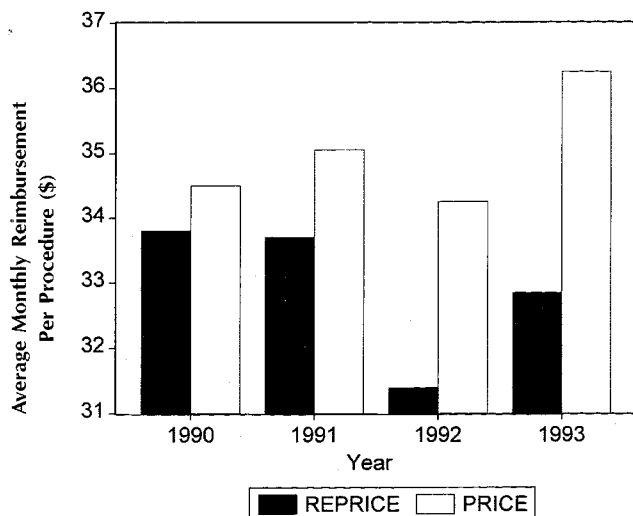
Further efforts at controlling costs must balance the budgetary constraints of payers against expanding new technology. However, the rapidly developing nature of medical technology limits the success of cost controls. As new surgical techniques are developed, payers have been unable to accumulate sufficient data about prices and the nuances of different surgical procedures to challenge and adjudicate a submitted surgical charge.⁴

Controlling costs also has become more difficult as the number of persons covered by health insurance in the United States has grown. The percentage of total

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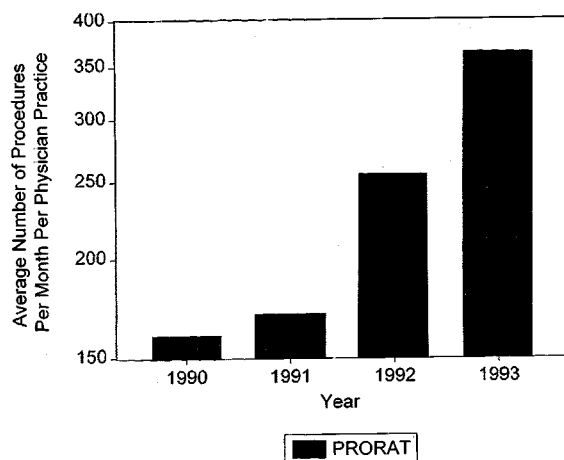
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Figure 1. Average Monthly Reimbursement Levels per Procedure from Insurers and Other Payers, Including Medicare, for 40 Physician Practices in Utah from January 1990 Through October 1993



PRICE = nominal reimbursement level per procedure; REPRICE = physician income per procedure. From Prime Source Managed Care, Salt Lake City, Utah.

Figure 2. Average Number of Procedures per Month for 40 Physician Practices in Utah from January 1990 Through October 1993



PRORAT = average number of procedures per month per physician. From Prime Source Managed Care, Salt Lake City, Utah.

healthcare expenditures paid out of pocket by patients has decreased from about 55% to 25%. The difference is made up at the expense of the government (Medicare, Medicaid, and Workers Compensation) and private health insurers.⁵

The primary purpose of our study was to evaluate how physicians react to cost-control measures. To make these determinations, we examined the reimbursement situation in the state of Utah in the early 1990s. We examined data from Management Plus, a subsidiary of Prime Source Managed Care (Salt Lake City, UT). Management Plus processed charges for physicians throughout Utah from 1983 to 1995. The services provided by the company included issuing physicians invoices to payers, collecting from payers, and sending bills to patients for any coinsurance, deductibles, or uncovered services. Management Plus provided these services for both generalist and specialist (eg, orthopedics, radiology, and internal medicine) practices. The data utilized in the study included practice level monthly figures from January 1990 through September 1993. The practice figures were aggregated and covered in excess of 10,000 monthly procedures in 1990, which increased to more than 14,000 by the end of 1993. The billed charges were obtained from the Health Care Financing Administration billing format submitted to payers. The reimbursement figures were obtained by reviewing the EOB level data plus the balance billing accounting data, which consider co-pays, deductibles, and coinsurance amounts. The figures are aggregate volumes, where no one physician had more than 4% of the overall billable procedure volume.

Effects of Reimbursement Levels on Physician Behavior: The Utah Experience

Data from Management Plus, which are not trended over time, for 40 different physician practices indicate that the nominal reimbursement levels per procedure in dollars have increased only moderately in almost 4 years (Figure 1), not only for Medicare but across the board for all payers. In real terms, physicians' income has dropped per procedure. The response by physicians to lower reimbursement levels has been to increase the number of billable procedures submitted to payers. The change in the number of procedures performed by the same 40 physician practices over the same period of time are shown in Figure 2.

Physicians experience both an income and a substitution effect as providers of healthcare services. The terms *income effect* and *substitution effect* are borrowed

from consumption theory but serve a useful purpose in highlighting physicians' individual economic behavior when confronted with changes in reimbursement levels. The negative income effect resulting from a decrease in real reimbursement levels is offset by the substitution effect of an increased number of procedures. The overall price effect is positive, suggesting that physician revenue continues to increase.

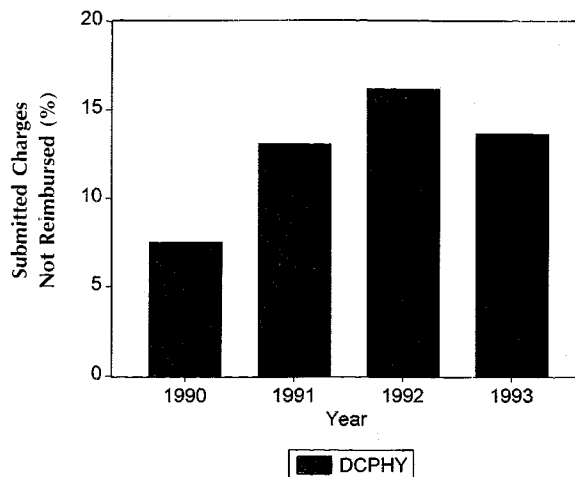
The response by physicians to decreasing reimbursement levels has been, in some cases, to create demand for certain procedures that have flexible clinical protocols and financial incentives. (*Herald Journal* [Logan, UT] January 3, 1995:17) In this context, financial incentives refer to how surgeons create demand when faced with increased competition for patients or changes in fee schedules by recommending a different mix of services to their patients than if they acted solely in the patients' best interests. How physicians price their services has both an income and a substitution effect. For example, a physician who might be reimbursed \$500 for an anterior cruciate ligament (ACL) repair can bill the payer for the clinically justifiable ACL and meniscectomy. The combination of reimbursement for both procedures might then be \$750.

The percentage of a medical provider's revenue controlled by a single payer (ie, payer size), size of the healthcare market, operating margins, and time costs are the key variables affecting physician pricing behavior. Payer and market size are important in determining how much a change in reimbursement levels will affect income relative to a substitution effect. The relative margins and time costs to physicians determine profitability (ie, higher operating margins and less use of the physician's personal time results in greater profitability). For example, physicians have a strong inducement to perform laboratory tests, since the marginal cost is low in relation to the fee and the physician's time cost is small.⁷

Over time, the difference between submitted charges and reimbursed payments made by payers (including individual patients who pay coinsurance and deductibles up to a certain level) has widened. Actual physician write-offs of unreimbursed charges grew from 5% to 7% in 1990 to about 12% to 16% in 1993 (Figure 3). Insurance payers have become far more demanding about the relationship between price and services rendered, including charges for office visits, laboratory tests, and x-ray films. In response, physicians perform more procedures with greater technologic complexity to maintain their income.

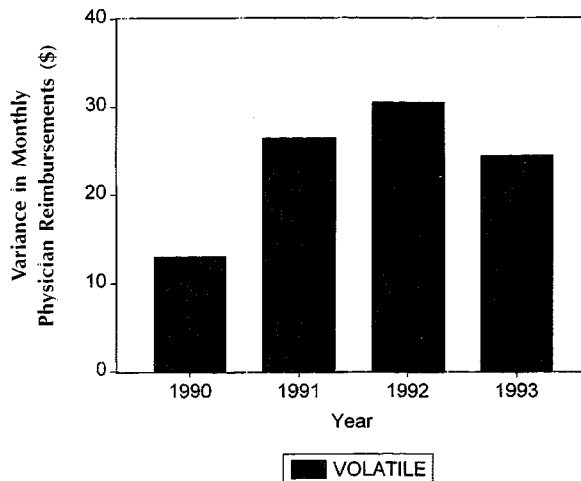
Greater variance in collecting reimbursements for services rendered (Figure 4) reduces the expected

Figure 3. Percentage of Charges Submitted by Physicians Not Reimbursed by Payers



DCPHY = difference between submitted charges and reimbursed payments. From Prime Source Managed Care, Salt Lake City, Utah.

Figure 4. Variance in Monthly Physician Reimbursements (VOLATILE) for 40 Physician Practices in Utah from January 1990 Through October 1993



From Prime Source Managed Care, Salt Lake City, Utah

level of collections by physicians. The decrease in expected level of collections is even worse if calculated in real terms. This verifies, to a certain extent, the comment by Escarce³ that physicians may be induced to generate more billable procedures as a substitution effect to offset a negative income effect. As the level of uncertainty regarding reimbursement increases, the expected returns required by physicians to maintain their level of income also increases.

Empiric Analysis of Physician Behavior

Billable Procedures and Price Behavior. When confronted with a constraint that causes a negative income effect, physicians behave strategically by submitting more billable procedures, thereby creating a substitution effect. We can evaluate the total price effect of this behavior by summing the negative income effect plus the substitution effect of the increased submission of medical procedures by physicians.

To evaluate this economic phenomenon, we conducted an ordinary least-squares regression analysis. We used data from Prime Source Managed Care physician billings from January 1990 through October 1993. Historically, a large portion of the total billable dollars among self-employed physician practices are allocated to nonmedical costs, including those for administrative staff, rent, and malpractice insurance. Thus, in most cases, any reduction in income at the margin reduces the physician's direct take-home pay. A physician's strategic response to this situation is limited by increasing expenses and limited overall revenue growth.⁸

We measured the change in the level of procedures billed and its relationship to structural variables. We also measured any monthly patterns in billed procedures (seasonality). The dependent variable for the regressions was the total billed procedures (PROCEDUR) for all physician practices. The state or explanatory variables were as follows:

STRUCT—binary variable used to assess whether the large increase in billed procedures is attributable to some structural change in the healthcare industry

QTIME—quadratic time variable

DCHPY—difference between the total charges billed and reimbursed payments collected from payers

VOLATILE—monthly variation in physician revenue or collected payments

$D_2 - D_{12}$ —11 dummy variables to test for seasonality

PRICE—average reimbursement per procedure for all physicians

REPRICE—average real reimbursement per procedure for all physicians

As shown in Table 1, we were able to establish a statistical relationship between the dependent variable and the state variable(s).

In regression #1, we found a weak relationship between the number of billed procedures and the average real reimbursement per procedure (REPRICE). Data from Prime Source Managed Care indicate that the average reimbursement remained relatively unchanged from 1990 through 1993, while the real level of reimbursement decreased slightly (Figure 1).

In regressions #2 and #3, the explanatory variables represent related measures of uncertainty among physicians. The DCHPY variable (the difference between submitted charges and collected payments) and the VOLATILE variable (the monthly variation in collected payments) appear to have signaled to physicians that they needed to increase their level of billed procedures over time. Both findings were statistically significant ($P < 0.05$).

Regression #4 revealed a structural change in the level of billable procedures submitted by physicians to payers in the early part of 1992. We attributed this finding to the heightened political awareness of healthcare reform in the presidential elections and increased adjudication efforts by payers. The STRUCT variable was statistically significant ($P < 0.01$).

Regression #5 was a multiple regression analysis (Appendix 1). Our model appears to be a good one, with an r^2 of .89 and an F statistic of 14.649, making the model significant at the 1% level. The low Durbin-Watson statistic of 1.098 suggests positive autocorrelation. Some multicollinearity exists between the DCHPY and VOLATILE variables because of the strong linear relationship between the two variables, making any forecast unreliable.

These regression analyses indicate that physicians, when confronted by increased variability in collected payments and flat nominal average reimbursements per procedure, have responded by increasing the number of procedures billed. With traditional insurance reimbursement for usual and customary charges, physicians can increase revenue by ordering additional blood tests, x-rays films, and other routine tests. With capitated reimbursement, physicians may have an economic incentive to undertreat patients because the reimbursement level is contractually fixed.⁹

Change in Physician Revenue. To measure the change in physician revenue over time given the constraints by payers, we developed a Box-Jenkins model to forecast the monthly levels of physician revenue (Appendix 2).

The model included 11 dummy variables to test for seasonality, a first-order autoregressive variable (AR), and a first-order moving average variable (MA). We found evidence of some seasonality because one of the 11 dummy variables had a statistically significant *t* statistic.

With the appearance of some seasonality in our results, our final model was defined as follows:

$$\begin{aligned}
 \text{Payments} = & -378,830 - .691(E_{t-1}) + \\
 & 1.0134(\text{Payments}_{t-1}) + \dots -91,167(D_{12}) \\
 t_{\text{calc}} & \quad (-.075) \quad (-3.51) \quad (11.01) \quad (-2.77) \\
 r^2 = & .888; n = 44; \text{Durbin-Watson} = 2.12; F = 17.79,
 \end{aligned}$$

where *E* represents the error term, and *Payments* is the monthly revenue collected by physicians.

Eighty-eight percent of the variance in actual physician revenue is accounted for by this model. The AR, MA, and *D*₁₂ variables are significant at a level of error of less than 1%. The AR and MA variables have no probability of error. The dummy variables all have very different probabilities of error, except for *D*₁₂. The model is statistically significant (*P* < 0.01).

The regressions shown in Table 1 indicate that billable procedures by physicians are highly correlated with volatility in collected payments, structural changes in the healthcare industry, and time. The revenue or *Payments* variable for physicians is trended and indicates some seasonality, because the *D*₁₂ dummy variable is statistically significant (*P* < 0.01).¹⁰

... CONCLUSIONS ...

Our results partially explain why physician earnings have grown, despite the efforts of employers and employees to find alternative healthcare delivery systems that constrain the growth of physician reimbursement. We found that, when faced with limitations on reimbursement, physicians seek to maximize income by billing for more procedures. As revenue-maximizing economic agents, physicians will be subject to the budget constraints of managed healthcare organizations rather than the aggregate of society's individual preference and demand for healthcare.

Table 1. Relationship Between Billed Procedures and Price Constraints

State Variables*	Regressions				
	#1	#2	#3	#4	#5
CONSTANT	7,690.11 (2.076)	6,299.66 (4.4167)	6,125.95 (4.632)	6,008.13 (11.584)	14,864.46 (2.108)
REPRICE	-9997.17 (-0.911)				-23131.211 (-1.431)
VOLATILE		104.01 (1.9644)			16.696 (0.068)
DCHPY			224.45 (2.285)		-148.385 (-0.372)
STRUCT				5,645.49 (7.782)	-480.563 (-0.513)
<i>D</i> ₂ , <i>D</i> ₁₂	All statistically insignificant				
QTIME					6.356 (8.246)
<i>r</i> ²	0.0025	0.0823	0.1083	0.5848	0.893
<i>F</i> statistic	0.1081	3.8590	5.223	60.559	14.649
Durbin-Watson statistic	0.1219	0.3362	0.393	0.383	1.098

t statistics are in parentheses.

*See the text for a description of each variable

Between 1990 and 1993, managed care organizations in Utah grew from 21% to 52% of the healthcare market.¹¹ Experience in Utah indicates that consumer utility has increased at the expense of the growth of physician revenue statewide. There is no significant evidence of physicians withholding services as patients shift from traditional fee-for-service insurance to managed care coverage. Nevertheless, these structural changes in healthcare delivery challenge physicians to improve the operational and clinical efficiency of their practices to increase revenue in the long run.

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Appendix 1. Regression #5

LS // Dependent Variable is PROCEDUR Date: 6-28-1995 / Time: 22:32 SMPL range: 1990.01 - 1993.09 Number of observations: 45				
VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG
C	14864.462	7050.9379	2.1081538	0.0441
REPRICE	-23131.211	16162.300	-1.4311832	0.1634
VOLATILE	16.696201	245.05649	0.0681320	0.9462
DCHPY	-148.38502	391.58393	-0.3789354	0.7076
STRUCT	-480.56390	935.58643	-0.5136499	0.6115
D2	-960.60356	1084.2654	-0.8859487	0.3832
D3	405.13957	1088.9130	0.3720587	0.7127
D4	-354.94472	1104.6240	-0.3213263	0.7503
D5	-163.52778	1094.0528	-0.1494697	0.8823
D6	-782.36147	1177.6654	-0.6643325	0.5119
D7	-1893.0278	1145.5754	-1.6524689	0.1096
D8	-1287.2948	1123.4710	-1.145819	0.2616
D9	-2059.4456	1166.1297	-1.7660520	0.0883
D10	-519.30911	1195.6241	-0.4343415	0.6674
D11	-1287.1529	1194.3954	-1.0776606	0.2904
D12	-2163.8856	1191.3292	-1.8163625	0.0800
QTIME	6.3561480	0.7708269	8.2458823	0.0000
r^2	0.893289	Mean of dependent var	8893.711	
Adjusted r^2	0.832311	SD of dependent var	3732.200	
SE of regression	1528.331	Sum of squared resid	65402244	
Log likelihood	-383.1138	F statistic	14.64940	
Durbin-Watson stat	1.098455	Prob (F statistic)	0.000000	

Appendix 2. Change in Physician Revenue

LS // Dependent Variable is PAYMENTS Date: 6-28-1995 / Time: 22:39 SMPL range: 1990.02 - 1993.09 Number of observations: 44 Convergence not achieved after 20 iterations				
VARIABLE	COEFFICIENT	STD ERROR	T-STAT	2-TAIL SIG
C	-378830.93	5064213.1	-0.0748055	0.9409
D2	-48550.660	29022.854	-1.6728424	0.1048
D3	1200.9363	39453.017	0.0304397	0.9759
D4	-2750.5158	46168.788	-0.0595752	0.9529
D5	14610.216	50609.722	0.2886840	0.7748
D6	-33101.223	53356.949	-0.6203732	0.5397
D7	-51863.756	54751.155	-0.9472632	0.3511
D8	-44983.870	55057.354	-0.8170365	0.4203
D9	-75869.893	54532.450	-1.3912797	0.1744
D10	4076.1675	50537.730	0.0806559	0.9363
D11	-70927.228	43955.315	-1.6136212	0.1171
D12	-91167.575	32922.480	-2.7691588	0.0095
MA(1)	-0.6912510	0.1970953	-3.5071925	0.0014
AR(1)	1.0134076	0.0920451	11.009900	0.0000
r^2	0.885214	Mean of dependent var	326812.8	
Adjusted r^2	0.835473	SD of dependent var	148931.7	
SE of regression	60409.47	Sum of squared resid	1.09E+11	
Log likelihood	-538.3991	F statistic	17.79662	
Durbin-Watson stat	2.128159	Prob (F statistic)	0.000000	