Containing Medicaid costs in an era of growing physician supply

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In this analysis, Medicaid cost containment is viewed within the theoretical framework of a price discrimination model. The value of viewing supply decisions made by physicians in terms of the conventional economic laws of supply and demand is demonstrated. Physicians are seen to respond to prices in a predictable way. As private prices increase, physicians are less willing to participate in Medicaid. As Medicaid prices increase, physicians are more willing to participate. Effects of changes in the number of persons eligible for Medicaid and in the physician supply are also analyzed.

Introduction

A major and continuing policy problem in the medical care area is how to impose some control over the costs of the Medicaid program. The purpose of this analysis is to shed additional light on this problem by identifying the independent effects of changes in Medicaid fees and Medicaid eligibility criteria, which are amenable to policy manipulation, and changes in private physician prices and physician supply, which (except in the relatively long run) are not. Although the latter two variables are outside policy control, they do have major effects on Medicaid program costs which can mute and even counteract the effects of changes in the two policy variables. The separate effects of the four variables must be disentangled so that the impacts of policy change can be properly assessed.

The focus of the study is the California Medicaid program during the period 1974-78. During this period, each of the variables of interest was changing, and such changes make possible quantifiable measurement of each variable's impact on the Medicaid program. Eligibility criteria were being relaxed; the Medicaid fee structure was increased substantially and "twisted" so that the new relative reimbursement rates favored particular procedures; private physician prices were increasing and so was physician supply. The current period contrasts with the period of our analysis in that Medicaid eligibility has been tightened, and stricter controls have been imposed on physician fees. Private prices and physician supply are increasing now, however, as they were then.

In the first section of this article, the conceptual approach is discussed. The data and estimation techniques are described in the second section. In the third section, the empirical results are presented with respect to the separate and combined effects of the four impact variables on the decisions of physicians as to whether or not to participate in Medicaid in the period 1974-78. In the fourth section, the results are presented with respect to the effect of the four impact variables on the amount of Medicaid services supplied, given the decision to participate. In the fifth section, our elasticity estimates are applied in order to examine the effect of the four impact variables on physician supply studied in the period 1974-78 as they pertain to the period 1981-82. In this way, we show how our results can be used to simulate the effects of changes in a different period from the one used for their derivation. Our more general conclusions are presented in the final section.

Conceptual approach

The conceptual approach used in the analysis of physician participation is the theory of the price discriminating firm. (In this respect, we follow and extend the work of other researchers; for example, see Hadley, 1979.) This approach is appropriate because, even though physicians may charge the same price to all patients, in effect, they receive potentially different returns for services to Medicaid patients than for services to private patients.

A physician's practice can be seen as a monopolistically competitive firm that sells services in two markets. In the first market, consisting of all non-Medicaid patients, the physician faces a downward sloping demand curve. In the second market, consisting of all Medicaid patients, the physician faces an infinitely elastic demand curve set at fixed fee levels. (Individuals covered by other insurance plans, such as Medicare-assigned patients and fully covered Blue Shield patients, could be represented in the same way.) Service production is represented by a cost curve of the usual shape, with increasing marginal costs over the relevant range.

The model can be described through the use of Figure 1.

Let Q = total services provided by a physician,
Q_p = services provided by a physician to private patients,
P = price charged per service to private patients,
P_m = Medicaid fee level,
MC = marginal cost function,
D_e = demand curve for Medicaid eligible patients,
D_p = demand curve for all other patients.

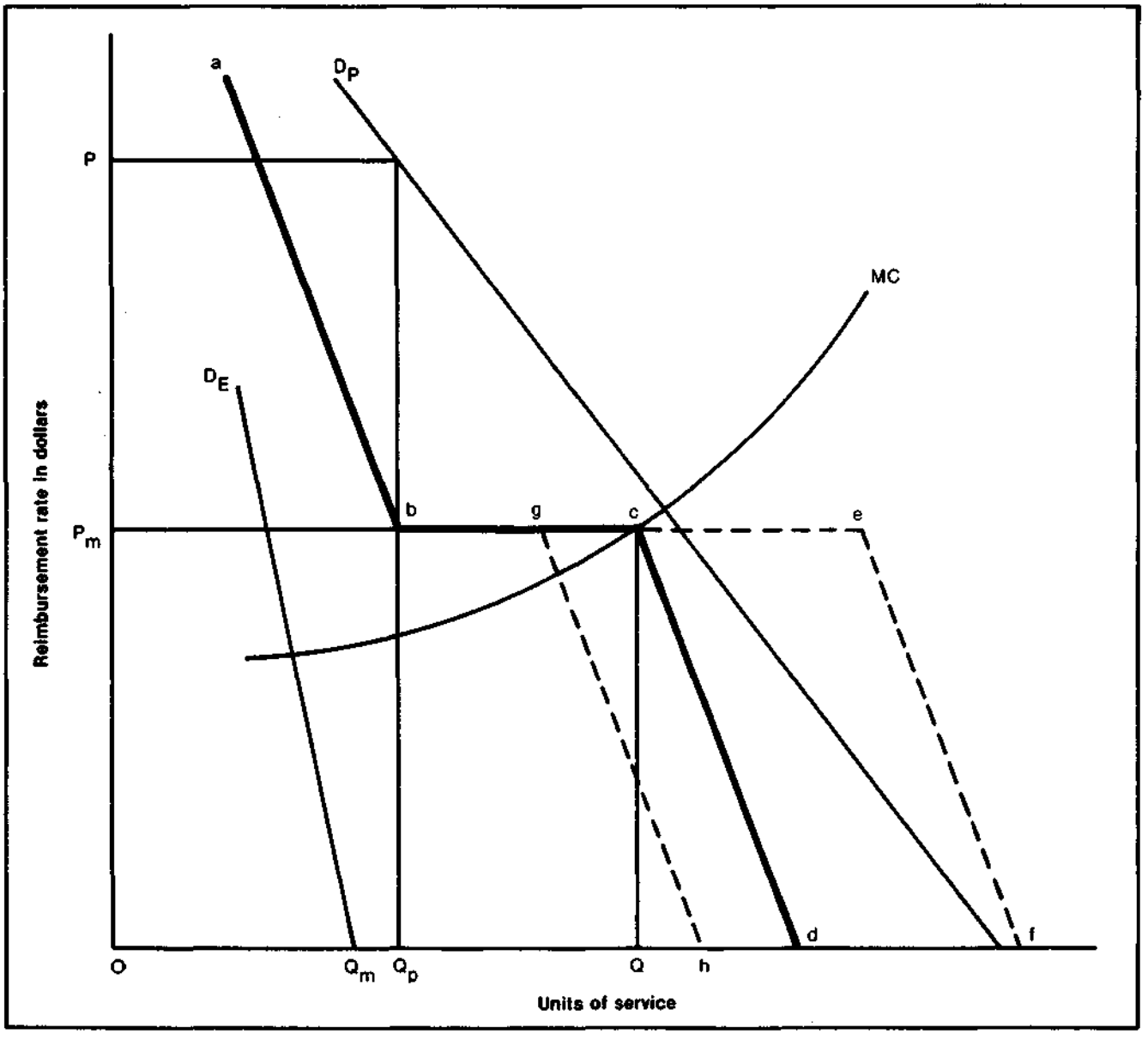
The demand curve D_P represents the demand for services of a given physician by private patients. The demand curve D_e represents the hypothetical demand curve of Medicaid eligibles had they not been eligible. Because they are indeed eligible and there is no costs sharing in Medicaid, the relevant Medicaid demand facing the physician is represented by the segment $0Q_m$, the amount of services Medicaid

patients demand at zero price. According to the theory of the price discriminating firm, physicians maximize profits by setting marginal revenue (revenue received for an additional unit of service) equal to marginal cost (cost of an additional unit) in both Medicaid and non-Medicaid markets. The marginal revenue curve is represented in this diagram by abcd.

The physician provides $0Q$ total units of service. Of these, $0Q_p$ units are provided to private patients at price P and the remainder $(Q\text{-}Q_p)$ to Medicaid patients at price P_m. If $0Q_m$, Medicaid demand, is greater than $(Q\text{-}Q_p)$—that is, if marginal revenue equals abef— then there is an excess demand for service by Medicaid recipients. In this case, the physician is unwilling or unable to provide all the services Medicaid recipients demand. If $0Qm$ is less than $(Q\text{-}Q_p)$— that is, if marginal revenue equals abgh— then the physician will be willing to supply more services to Medicaid patients than they demand. Clearly, use of this model suggests that the amount of service a physician provides to Medicaid patients depends on the level of non-Medicaid demand and on other factors affecting physician willingness to supply services, such as costs, Medicaid fees, and the amount of potential Medicaid demand (depending on Medicaid eligibility criteria), in the market area.

Figure 1

Physician supply in the Medicaid and private markets



This model has several implications for Medicaid policy. First, the effect of an increase in Medicaid reimbursement rates on supply of services will depend on whether or not there is excess demand for physician services at the initial fee level. If there is excess demand at the initial fee level, increases in the Medicaid fee level will result in an increase in the supply of services to Medicaid. However if there is no Medicaid excess demand, even if fees are increased, Medicaid utilization will be increased only if physicians take actions that reduce the effective cost of their services to Medicaid eligibles. For example, the time cost to patients can be reduced by shortening waiting times to obtain an appointment and times spent in the waiting room or having more office hours, perhaps in the evening or on weekends. With respect to a Medicaid fee reduction relative to private fees, in the presence of excess Medicaid demand, physicians will supply fewer Medicaid services. Without excess Medicaid demand, physicians' preference for supplying fewer Medicaid services will not affect Medicaid utilization because available services will still satisfy demand.

A second implication of the model is that if excess Medicaid demand already exists, an increase in eligibility will not result in an increase in utilization. An increase in Medicaid eligibility will result in increased utilization only if Medicaid fees are high enough to increase supply (i.e., to make physicians willing to treat more patients or provide more services to their existing patients). Similarly, a reduction in eligibility will not reduce utilization if excess demand exists.

A third implication is that an increase in the physician-to-population ratio has the effect of shifting downward the demand curve faced by any individual physician. Thus, an increase in the ratio will mean that more Medicaid patients will be seen at any given fee level. Any other factor that reduces private demand (e.g., an increase in unemployment or reduction in real income) will have the same effect.

A fourth implication of the model is that an upward shift in the marginal cost curve (say, because of increases in malpractice costs or wage rates) will induce physicians to see fewer Medicaid patients. In fact, the output of services to Medicaid patients will go to zero before the physician raises prices (and presumably reduces quantities) in the private market, as will happen if marginal cost intersects marginal revenue above the Medicaid fee.

In our empirical analysis we test the hypotheses implicit in the model by focusing on two aspects of physician behavior:

- Whether or not a physician chooses to participate in the Medicaid program.
- The amount of Medicaid services supplied by a participating physician.

The second aspect will be pursued by examining three measures of services supplied:

- The total number of relative value units (RVU's), supplied to Medicaid patients in a 3-month period.[1]
- The number of different Medicaid patients treated in a 3-month period.
- The average number of RVU's per patient treated.[2]

Data and estimation techniques

The analysis presented here is based on physician-specific data for the provision of Medicaid services in the first calendar quarters of 5 consecutive years, 1974-78. The unit of observation is a solo-practice physician. The sample of providers is drawn from the California statewide population of solo, office-based physicians who had Blue Shield identification numbers, regardless of whether they filed Medicaid claims. Physicians typically obtain Blue Shield numbers upon licensure; hence, this population includes nearly all California physicians. Within this group, the sample is limited to doctors who were continuously in practice from 1972 through 1978 and had not changed their location or specialty.

Six specialties were chosen for the analysis: general and family practice, internal medicine, pediatrics, obstetrics-gynecology, general surgery, and orthopedic surgery. (For this study, general practice and family practice are deemed one specialty.) The four primary care specialties are analyzed separately from the two surgical specialties. The distribution of sample practitioners across specialties is presented in Table 1.

[1] Relative value units are from a scale that assigns relative "worth," or value, to each procedure. The California Medicaid program bases provider reimbursement on this scale.

[2] More detail on the methodology used can be found in Held, Holahan, and Carlson (1983).

Table 1

Number and percent distribution of sample solo-practice physicians, by specialty: California, 1974-78

Specialty	Number	Percent distribution
Primary care		
All primary care	2,208	100.0
General and family practice	997	45.2
Internal medicine	807	36.5
Obstetrics-gynecology	208	9.4
Pediatrics	196	8.9
Surgery		
All surgery	820	100.0
General surgery	634	77.3
Orthopedic surgery	186	22.7

Table 2

Percent of solo-practice physicians participating in Medicaid, by year, specialty, and definition of participation (patient minimums): California, 1974-78

Specialty and patient minimum per quarter	1974	1975	1976	1977	1978
Primary care			Percent		
1	69.7	73.9	72.1	71.3	68.9
10	47.6	52.0	50.4	52.1	48.7
20	35.4	39.7	38.3	40.2	38.4
Surgery					
1	74.4	80.6	77.9	75.7	73.9
10	43.9	52.3	48.9	50.4	47.4
20	27.1	32.8	32.3	33.3	31.3

The data used in this analysis were obtained from Blue Shield of California, the Medicaid carrier for the State. Data from individual patient claims were aggregated, and variables suitable for multivariate analysis were created for physicians. Claims submitted on behalf of patients eligible for both Medicare and Medicaid were excluded because these claims are subject to Medicare, rather than Medicaid, reimbursement policies. County-specific information about the area in which each physician practiced was matched to the individual physician records to form the final analysis file.

The physician-specific data include average amount billed per relative value unit (RVU), average amount paid (allowed) by Medicaid, total number of RVU's provided in the first quarter of each year, and number of different patients seen during the same period. These data include the following specialty codes: locations of professional standards review organizations, county identifiers, and dates of medical school graduation for all physicians regardless of their participation status in Medicaid and Medicare. If a physician also participated in Medicare, his or her billed and allowed amounts per RVU for Medicare are also included.[3]

The county-specific data include information on the Medicaid eligibility, employment status, age and racial composition, and density of the county population; measures of per capita income, average new house values, and physicians' office employee salaries; and counts of the number and specialty distribution of physicians in the county.

Physicians were grouped by specialty into two broad classifications, primary care and surgery, and separate sets of equations were estimated for each group. Primary care practice includes general and family practice, pediatrics, internal medicine, and obstetrics-gynecology. Surgery includes general and orthopedic surgery. We aggregated across procedure groups such as medicine and surgery by employing 1969 and 1974 RVU's.

The individual physician is the unit of analysis, and we use two estimation techniques on the same general set of explanatory variables. First, we use probit estimation to explain the decision whether or not to participate in Medicaid. Probit is preferred to linear regression in this case because the participation decision (yes or no) is a binary dependent variable. Second, we use linear regression for analyzing the amount of services supplied by participants, because the supply measures are continuous dependent variables. The explanatory variables in each case are prices, physician characteristics, and area characteristics. Each model takes the form:

$$Y_i = a_0 + b_1 x_{i1} + b_2 x_{i2} + \ldots b_j x_{ij},$$

where: Y_i is a measure of supply (participation or measure of output) for physician i;
x_{ij} is independent variable j for physician i;
b_j are the parameters to be estimated.

Decision to participate

Participation rates by year employing three alternative definitions of participation are shown in Table 2. It is hardly surprising that, as the definition of participation is set at increasingly higher patient minimums per quarter, the participation rate decreases. Under a definition of 10 or more patients per quarter, 50.4 percent of the primary care physicians were participants in 1976. No obvious trends in participation rates over time can be seen in Table 2. However, it would not be correct to conclude that physicians did not respond to the increased Medicaid fee schedule. These are "gross" participation rates showing the effect of all the different forces confronting physicians taken together. There could be effects, such as an increase in the demand for services by private-pay patients, that offset the effect of fee schedules on the willingness to

[3] In Held, Holahan, and Carlson (1983), we examined the potential problems caused by the fact that the prices physicians set for their own services are unlikely to be independent of their supply decision and by the potential serial correlation of observations that derive from the panel nature of our data. We concluded that bias from either of these sources is unlikely.

participate. The results in Table 2 do not allow us to separate the effects. To determine the true effect on participation of the Medicaid fee schedule changes, we turn to our multivariate results, which allow us to isolate the independent effects of the various factors.

A few words are in order about our definition of participation. The issue is how to separate physicians who have made an explicit decision to treat Medicaid patients from those who encounter an occasional Medicaid patient on an emergency or other sporadic basis for which the patient's Medicaid status is not a relevant criterion for treatment. To see the extent to which price elasticity estimates are sensitive to choice of participation, we compared calculations for each of three definitions: 1 patient per quarter, 10 patients per quarter, and 20 patients per quarter. The comparison is shown in Table 3.

Table 3

Price elasticities of solo-practice Medicaid physician participation, by definition of participation (patient minimums), type of price, and specialty: California, 1974-78

Price per relative value unit and specialty	Patient minimum per quarter		
	1	10	20
Private price			
Primary care	−0.28	−1.04	−1.48
	(4.82)	(10.42)	(11.37)
Surgical	−0.50	−0.99	−0.92
	(7.30)	(6.71)	(4.42)
Medicaid price			
Primary care	0.16	0.60	0.79
	(1.80)	(3.97)	(4.02)
Surgical	1.24	1.79	1.43
	(11.52)	(7.75)	(4.31)

NOTE: Asymptotic *t* statistics for the estimated coefficients on which the elasticities are based are shown in parentheses.

Table 4

Probit estimates of the decision by solo-practice physicians to participate in the Medicaid program, by specialty: California, 1974-78

Item	Primary care		Surgery	
	Coefficient	*t* statistic	Coefficient	*t* statistic
INDEPENDENT VARIABLE				
Price in dollars				
Private price	−1.58	−10.42	−1.35	−6.71
Medicaid price	1.37	3.97	3.80	7.75
Medicaid eligibility				
Nonaged eligibles per physician	0.86	10.88	0.97	7.15
Proportion of population:				
Disabled	2.07	2.97	3.15	2.72
On AFDC[1]	−0.35	−0.94	−0.47	−0.76
Medically needy	1.39	1.74	−0.73	−0.55
Physician supply				
Physicians to non-Medicaid population	−196.3	−2.60	−456.2	−3.60
Physicians to non-Medicaid population (squared)	55.1E3	4.69	11.8E4	6.02
CONTROL VARIABLE				
Physician characteristic				
Years experience	−0.23E-1	−3.90	−0.87	−0.68
Years experience (squared)	−0.44E-4	−0.45	−0.59E-3	−2.66
Internal medicine binary	−0.44	−14.52	—	—
Pediatrics binary	−0.17	−2.81	—	—
Obstetrics-gynecology binary	0.41	6.14	—	—
Orthopedic surgery binary	—	—	0.99E-1	1.87
Cost of inputs				
Housing cost	−0.81E-3	−0.64	−0.44E-2	−2.05
Wages in physicians' offices	0.16E-1	3.92	−0.51E-2	−0.81
Population per square mile	−9.63E-5	−5.70	−0.20E-3	−7.25
Year binary				
1975	0.13	2.85	0.32	4.23
1976	0.27	4.89	0.35	3.97
1977	0.21	3.26	0.23	2.25
1978	0.21	2.90	0.22	1.93
OTHER STATISTICS				
Constant	0.74	1.82	−0.33	−0.49
Mean of dependent variable	0.5110		0.4967	
Chi-square	1,178		672.5	
Sample size	9,931		3,750	

[1] Aid to Families with Dependent Children.

NOTE: Sample includes participants and nonparticipants. Participation is defined as seeing 10 or more Medicaid patients per quarter. Coefficients are maximum likelihood estimates of a standardized index of the probability of participation in the Medicaid program (i.e., coefficients are not the partial derivative of the probability itself). E is an exponent to the base 10.

Table 5

Regression estimates of Medicaid supply responses for participating primary care solo-practice physicians: California, 1974-78

Item	Dependent variables: Total RVU's[1] per quarter		RVU's[1] per patient		Patients per physician	
	Coefficient	*t* statistic	Coefficient	*t* statistic	Coefficient	*t* statistic
INDEPENDENT VARIABLE						
Price in dollars						
Private price	−3,831.4	−2.95	−13.78	;2.29	−79.45	3.37
Medicaid price	4,814	1.53	2.48	0.17	99.76	1.74
Medicaid eligibility						
Nonaged eligibles per physician	40.86	6.80	0.13E-1	0.45	0.92	8.38
Proportion of population:						
Disabled	2,297.4	0.42	−40.58	−1.59	84.44	0.85
On AFDC[2]	14,952	4.93	59.60	4.24	201.60	3.66
Medically needy	25,894	3.92	219.00	7.16	209.10	1.74
Physician supply						
Physicians to non-Medicaid population	2.33E6	3.78	3,165	1.11	38,493	3.44
Physicians to non-Medicaid population (squared)	−3.31E7	−3.35	15.95E4	0.35	−4.99E6	−2.78
CONTROL VARIABLE						
Physician characteristic						
Years experience	−229.3	−4.54	−0.79	−3.39	−2.63	−2.86
Years experience (squared)	1.77	0.89	0.48E-2	1.18	.022E-1	1.34
Internal medicine binary	−1,528	−5.78	23.66	19.33	−56.61	−11.79
Pediatrics binary	2,572	5.53	−3.93	−1.82	73.91	8.75
Obstetrics-gynecology binary	6,588	17.54	66.78	38.41	−1.13	−0.17
Orthopedic surgery binary	—	—	—	—	—	—
Cost of inputs						
Housing cost	−16.28	−2.00	0.95E-1	2.24	−0.45	−2.73
Wages in physicians' offices	1.32	0.44E-2	−0.59E-1	−0.43	0.47	0.87
Population per square mile	500.0	3.36	−0.58	−0.83	6.80	2.48
Year binary						
1975	1,157	3.01	8.22	4.62	8.67	1.24
1976	2,170	4.91	12.73	6.23	21.61	2.70
1977	2,005	3.76	−2.07	−0.84	41.38	4.27
1978	1,754	3.00	−9.87	−3.66	51.75	4.89
OTHER STATISTICS						
Constant	−117.8	−1.94	−9,616.5	−2.87	4.21	0.27
Mean of dependent variable	4,942.7		59.1		93.9	
R^2	0.12		0.10		0.30	
Sample size	5,065		5,065		5,065	

[1] Relative value units.
[2] Aid to Families with Dependent Children.

NOTE: Participation is defined as seeing 10 or more different Medicaid patients per quarter. E is an exponent to the base 10.

The coefficient estimates have very small standard errors, are quite robust regardless of the definition of participation, and generally show a high elasticity. Although the quantitative estimate of the elasticity varies with the definition chosen, the basic message to be derived from these results does not depend on the definition of participation. Clearly, the participation decision is quite sensitive to price levels irrespective of the definition chosen. The elasticities are generally in excess of 0.5; only for the least stringent definition is the price elasticity ever less than 0.5. Therefore, we made an essentially arbitrary choice between our other two measures and use 10 patients per quarter as our cutoff point.

The precise probit estimates of participation are presented in Table 4, and the precise supply regressions are presented in Tables 5 and 6. To simplify the discussion, we have derived elasticities from the parameter estimates and used them in the presentation of results. The elasticity estimates are provided in Tables 7 and 8.

The results for the Medicaid eligibles per physician, physician supply, and time variables are also of interest. The Medicaid eligibility variable was positively and significantly related to participation rates of both primary care physicians and surgeons, with elasticities of 0.36 and 0.41, respectively (Table 7). This means that physician participation rates increase as Medicaid eligibles increase. Similarly, the results for the physician supply variables were also statistically significant for both primary care and surgery, with elasticities of 0.16 and 0.30, respectively (Table 8). Treating Medicaid patients seemingly becomes more attractive as the physician supply expands. The fact that both the Medicaid eligibility and physician supply variables are positively related to participation (and, as will be seen, to the supply of services) suggests that some physicians face excess

Table 6

Regression estimates of Medicaid supply responses for participating solo-practice surgeons: California, 1974-78

Item	Dependent variable: Total RVU's[1] per quarter		RVU's[1] per patient		Patients per surgeon	
	Coefficient	*t* statistic	Coefficient	*t* statistic	Coefficient	*t* statistic
INDEPENDENT VARIABLE						
Price in dollars						
Private price	−1,478	−1.75	23.4	2.13	−23.5	−1.73
Medicaid price	5,102	2.05	−76.5	−2.36	99.85	2.50
Medicaid eligibility						
Nonaged eligibles per physician	23.81	4.63	0.47E-1	0.70	0.39	4.66
Proportion of population:						
Disabled	−4,215	−0.92	−86.4	−1.44	12.7	0.17
On AFDC[2]	6,015	2.87	42.3	1.55	54.8	1.63
Medically needy	8,102	1.59	218.3	3.28	22.0	0.27
Physician supply						
Physicians to non-Medicaid population	7.98E5	1.52	−6,730	−0.98	27,345	3.24
Physicians to non-Medicaid population (squared)	−1.70E8	−2.12	1.87E6	1.79	−5.62E6	−4.37
CONTROL VARIABLE						
Physician characteristic						
Years experience	−62.58	−1.09	0.96	1.28	−1.31	−1.42
Years experience (squared)	0.91E-3	0.80E-3	−0.29E-1	−2.12	0.13E-1	0.75
Internal medicine binary	—	—	—	—	—	—
Pediatrics binary	—	—	—	—	—	—
Obstetrics-gynecology binary	—	—	—	—	—	—
Orthopedic surgery binary	−947.8	−4.55	−18.85	−6.94	−9.82	
Cost of inputs						
Housing cost	7.98	0.91	−0.17	−1.48	0.28	1.97
Wages in physicians' offices	2.75	0.11	0.15	0.45	0.81E-2	0.19E-1
Population per square mile	340.0	2.82	−3.10	−1.99	8.80	4.62
Year binary						
1975	402.1	1.30	6.01	1.49	−1.08	−0.22
1976	1,094	3.02	8.71	1.85	4.93	0.85
1977	834.2	1.96	5.77	1.04	3.26	0.48
1978	436.1	0.92	−2.91	−0.47	2.97	0.39
OTHER STATISTICS						
Constant	−3,743	−1.40	76.1	2.19	−73.2	−1.71
Mean of dependent variable	3,278.6		80.82		45.64	
R^2	0.07		0.06		0.05	
Sample size	1,874		1,874		1,874	

[1] Relative value units.
[2] Aid to Families with Dependent Children.

NOTE: Participation is defined as seeing 10 or more different Medicaid patients per quarter. E is an exponent to the base 10.

demand and therefore respond to higher fees, but that others do not and therefore respond to increased eligibility.

In Table 7, our participation results for primary care and surgery are summarized. The percentage change in each impact variable over the 4-year period is shown in the first column. The elasticity estimates derived from our estimating equations are shown in the second column. In the last column, our estimated effects for primary care (top panel) and surgery (second panel) are shown. The first number in each panel is the percent probability that a physician (primary care or surgery) would participate in Medicaid if there had been no change in the four variables during the period. The next four numbers are our estimates of the effect of change on that probability in each of four variables. The last number in each panel is the combined effect of the four.

As can be seen, the direction of effects is similar for primary care and for surgery, although their magnitudes are somewhat different. Let us discuss each in turn.

For primary care, in the absence of any changes in policy or market conditions during the period 1974-78, the probability of participation for a physician was slightly over 50 percent. Ignoring any time trends, this probability would have decreased substantially to 37.1 percent ($52 - (0.287 \cdot 52)$) by 1978. This outcome reflects the combined effect of four factors, three positive factors counterbalanced by the fourth large negative effect. Medicaid prices increased by 20 percent, causing (had other things been equal) a positive change in the probability of participation of 12 percent. Medicaid eligibility per physician also increased by 15 percent, causing an increase in the probability of participation of 5.5 percent. If private fees and the supply of physicians had not changed over the period, therefore, the

Table 7

Quantitative effects on solo-practice physicians participation in Medicaid: California, 1974-78

Specialty and impact variable	Percent change 1974-78	Elasticity	Implied effect percent
Primary care			
Mean probability of participation with no change in 1974 situation	—	—	—
	—	—	52.0
Medicaid price	20.0	0.60	12.0
Medicaid eligibles per physician	15.2	0.36	5.5
Private price	46.4	−1.04	−48.3
Physicians per private population	13.4	0.16	2.1
Combined effect[1]	—	—	−28.7
Surgery			
Mean probability of participation with no change in 1974 situation	—	—	50.0
Medicaid price	10.0	1.79	17.9
Medicaid eligibles per physician	15.2	0.41	6.2
Private price	40.0	−0.99	−39.6
Physicians per private population	13.4	0.30	4.0
Combined effect[1]	—	—	−11.5

[1] This is the percent change in the participation rate. For example, the change for primary care would be −0.29 × 0.52, or −0.150. When taken from the base rate of 52.0 percent, this would imply 52.0 - 15.0, or 37.0 percent of the physicians participating in Medicaid.

NOTE: Participation is defined as seeing 10 or more different Medicaid patients per quarter.

Table 8

Quantitative effects on Medicaid services supplied: California, 1974-78

Specialty and impact variable	Percent change 1974-78	Total Medicaid relative value units per physician			Medicaid patients per physician		
		Elasticity	Implied effect		Elasticity	Implied effect	
			Number	Percent		Number	Percent
Primary care							
Supply with no change in 1974 situation	—	—	4,942	—	—	93.9	—
Medicaid price	20.0	0.56	554	11.2	0.61	11.5	12.0
Medicaid eligibles per physician	15.2	0.47	751	7.1	0.55	7.9	8.4
Private price	46.4	−0.54	−1,238	−25.1	−0.37	−16.1	−17.2
Physicians per private population	13.4	1.08	715	14.5	0.39	4.9	5.2
Combined effect	—	—	782	15.8	—	8.2	8.7
Time trend, 1974-78	—	—	1,754	—	—	51.8	—
Surgery							
Supply with no change in 1974 situation	—	—	3279	—	—	45.6	—
Medicaid price	10.0	0.92	302	9.2	1.29	5.9	12.9
Medicaid eligibles per physician	15.2	0.40	199	6.1	0.47	3.3	−22.3
Private price	40.0	−0.37	−576	−17.6	−0.47	−10.2	−22.3
Physicians per private population	13.4	0.01	4	0.1	−0.01	−0.6	−0.1
Combined effect	—	—	−71	−2.2	—	−1.6	−3.5
Time trend, 1974-78	—	—	436	—	—	−3.0	—

Medicaid policy changes would have increased the probability that a physician would participate by 17.5 percent (12.0 + 5.5), or from 52 to 61.1 percent, with a correspondingly increasing effect on program costs. They did change, however. Physician supply (measured by physicians per non-Medicaid population) increased, but its effect on participation was minor. The biggest factor by far was the increase in private physician prices (more than twice the rate of increase in Medicaid prices). Because the probability of participation in Medicaid is rather sensitive to the relative ratio of Medicaid price to private price, this increase caused a major reduction in the probability of participation that more than counteracted the effects of the policy changes and caused the overall effect on participation to be negative. Offsetting the private price, to some extent, was the time effect noted earlier.

The similar pattern with respect to surgery is also shown by the parameters in Table 7. Surgeons appear to be more sensitive to the Medicaid price and less to the private fee price than primary care physicians are. This result is consistent with the view that the supply of surgeons relative to the demand for their services may be greater than is the case for primary care physicians.

Amount of Medicaid services supplied

We now turn to our results with respect to the amount of services supplied to Medicaid patients by participating physicians. (Participation, as before, is defined as seeing at least 10 different Medicaid patients per quarter.) The results reported in this section are, in our judgment, the major contribution of the paper, because the amount of services supplied is the major determinant of program costs.

As can be seen in Table 5 and summarized in Table 8, we use two alternative measures of the amount of services supplied. The first is total Medicaid relative value units (RVU's) supplied per quarter, and the second is the number of Medicaid patients treated by a physician. The former is the more appropriate measure of supply when the focus is on program costs because it is sensitive to service intensity as well as to the number of patients. As before, our measure of Medicaid eligibility is Medicaid eligibles per physician; our measure of physician supply is physicians per non-Medicaid (private) population.

The results are shown in Table 8. For primary care physicians, private prices were negatively related and Medicaid-allowed amounts positively related to both variables. The elasticities were -0.54 and 0.56, respectively, in the total Medicaid RVU's per physician equations; they were -0.37 and 0.61 in the Medicaid patients per physician equations. The Medicaid eligibles per physician variables was positively related to both dependent variables, with elasticities of 0.47 for total RVU's and 0.55 for Medicaid patients. Physician supply was also positively related, with elasticities of 1.08 for total RVU's and 0.39 for Medicaid patients.

The time trend (Table 8) was also strongly correlated with the number of both RVU's and Medicaid patients per quarter. The number of Medicaid patients per physician increased by almost 52 patients and the number of relative value units by 1,754 from 1974 to 1978, all else being equal.[4] This implies a major change in the willingness of physicians to see more patients and provide more services over this period.

[4] As discussed in Held, Holahan, and Carlson (1983), there is a basic issue of whether or not to include a year binary in the estimations. A case can be made for both specifications, although we prefer the current one. Because the level of the Medicaid fee was increased in 1976, part of the impact of the fee change will be captured by the time binary. Consequently, the Medicaid price elasticities reported here may be biased low (i.e., the Medicaid price elasticity may be higher than that reported here). The reference paper contains both sets of estimates. The net effect if the Medicaid price elasticity is biased low is to bias the results presented in Tables 7 and 8 toward the negative.

The results for the surgery equations were similar. The Medicaid price variable (Table 8) was again positive, with higher elasticities than in the primary care equations (0.92 for total RVU's and 1.29 for Medicaid patients). The private price variable was again negative, with elasticities of -0.37 for total RVU's and -0.47 for Medicaid patients. The number of Medicaid eligibles was again positively related to both supply variables: elasticities were 0.40 for RVU's and 0.47 for Medicaid patients. The supply of physicians, for all practical purposes, appears to have had no effect on the supply of services by surgeons. The time trends (Table 8) were also relatively unimportant in these equations.

In Table 8 we use these results to summarize the effects of these four impact variables on outcomes during the period 1974-78. We turn first to primary care. Measuring the amount of services supplied by total RVU's per physician, we see that the overall effect of the 1974-78 changes was an increase of 782 RVU's on a base of 4,942— in other words, a 15.8-percent increase in the number of RVU's supplied to Medicaid eligibles by participating primary care physicians. As with participation, this overall effect was the combination of three positive effects and one negative effect which, although representing the largest single effect, did not completely outweigh the other three. The effects of the policy changes (relaxed eligibility policy and increased Medicaid prices) were positive, causing an increase of 1,305 RVU's (554 + 751), or 18.3 percent, per primary care physician. The effect of the substantial increase in private fees was, again, large and negative. If there had been no increase in physician supply, the private price effect (-1,238) would have almost canceled the effect of the two policy changes. Physician supply increased also, however, stimulating an increase of 715 RVU's (14.5 percent). The overall effect was an increase of 782 RVU's. In addition to the impact of these four changes, the effect of the time trend was strongly positive, resulting in substantial overall increases in Medicaid services.

When services supplied are measured by the number of patients per physician, the overall effect of the 1974-78 changes is still positive but not as large (Table 8). As before, the overall effect was a combination of the positive effects of the Medicaid program changes, a large offsetting negative effect of the large relative increase in private prices, and a moderate positive effect of increased physician supply. Again, a separate time trend was strongly positive. In the case of primary care physicians, therefore, other factors changing physician behavior over this period were at least as important as the policy variables included in the model. The results, however, do demonstrate the importance of the policy changes.

For surgeons, the patterns of change are again similar, although the Medicaid price change was less. The effects of all four variables combined (lower panel, Table 8) were generally smaller for the RVU measure and canceled out almost completely, for a

minor overall negative effect on RVU's of 2.2 percent. For the Medicaid patients per physician measure, the overall effect was still small (a decrease of 3.5 percent). Once again, we see that the major mitigating effect was the high private-to-Medicaid price ratio. In addition to these combined effects, the time trends were small. Without the effect of more rapidly increasing private prices, which reduced Medicaid supply, the effect of the Medicaid policy changes would have been to produce greater upward pressure on program costs.

Simulating the effects of 1981-82 Medicaid changes

We noted at the beginning of the article that the four impact variables in our analysis have *not* recently been changing in the same direction as they were for the period 1974-78. However, the elasticity estimates we derived from our empirical examination of the earlier period in California might be used to separate the contribution of the recent Medicaid *national* policy trends (tightened eligibility and stricter price control) from the overall changes that have occurred.

We do this by applying our separate elasticity estimates to the percent changes that we either know or estimate to have occurred in the period 1981-82 to see how close our estimates of the overall effects are to the actual record. If this approach can predict the overall observed effect on the Medicaid program for a later period, then it would suggest that our elasticity estimates of the direction and relative magnitude of the separate effects are also good approximations of actual physician supply decisions.

We chose to perform this exercise for the amount of services supplied, using as our measure the total amount of RVU's per physician per quarter. Our choice was dictated by two considerations. First, the amount of services supplied, given participation, has a much greater effect on program costs than the participation decision itself. Second, for reasons already noted, total RVU's provides a more refined measure of services supplied than does number of patients per physician. Our results are shown in Table 9, which has basically the same format as Table 8.

Our elasticities produce estimates of decreases in the supply of physician services to Medicaid eligibles of 5.61 percent for primary care physicians and 3.64 percent for surgeons (Table 9). Combining these estimates would yield an estimate of the decrease in the overall supply of physician services lying somewhere between the two. According to estimates made independently from reported total program expenditures for physicians for another purpose, the actual change for the period 1981-82 was in the neighborhood of a 2.14-percent decrease—in the same direction but somewhat smaller quantitatively (Holahan, 1984).

The difference in magnitude between the two sets of estimates is probably explained in part by the fact that our elasticities were derived using data from a period of rising program costs. This is likely to produce elasticities that will overestimate price change in periods of decreasing inflation, because in mixed economies like the United States, prices tend to be more "sticky" downward than upward. Nevertheless, the comparisons are quite close.

This difference in magnitude of the overall effect, however, need not bias the relative contributions of the constituent parts. As can be seen in the case of primary care, the recent policy movements in the direction of Medicaid cost control, other things being equal, would most likely have reduced the supply of physician services and therefore reduced costs. The increase in supply of physicians, however, tipped the balance, leading to a net increase ($2.80 + 2.56 - 4.54 = 0.82$). The substantially greater increase in private physician prices than in Medicaid prices is what finally made the net effect negative. With respect to surgery, the picture is even clearer. The policy variables by themselves would not have been sufficient to have led to an overall reduction in Medicaid services supplied ($4.60 - 3.86 = 0.74$). The estimated effect of physician supply for surgery, in contrast to that for primary care, was almost nonexistent. What brought about the decrease in Medicaid services, and therefore costs, is again the high rate of increase in private prices relative to Medicaid prices.

The conclusion from this admittedly crude example is an interesting one. From the point of view of reducing health care costs for public programs, numerous and separate effects occur simultaneously, and the simple net result masks considerable counteracting effects. The final result of a given single-item policy change is not likely to be obvious. For example, if the rate of private physician price change decreases, as seems likely to be the case, one effect will be an increase in the rate of program costs compared to the rate in the immediate past, when private price changes had a major impact on the rate of program cost decreases.

Conclusions

These empirical results provide a picture of physician participation in the Medicaid program which shows that both research and policy issues can be usefully viewed within the theoretical framework of a price discrimination model. In particular, the value is demonstrated of viewing the supply decisions made by physicians in terms of the conventional economic laws of supply and demand. The parameter estimates are also consistent with previous research, indicating that the setting of Medicaid reimbursement rates may offer a powerful and efficient policy lever for affecting the cost and use of physicians in the Medicaid program. Our general conclusions regarding the Medicaid fee effects on supply of physician

Table 9

Test of supply elasticities estimated from 1974-78 California data on 1981-82 national changes in the Medicaid program

Speciality and impact variable	Percent change 1981-82	Total Medicaid relative value units per patient: Elasticity 1974-78	Total Medicaid relative value units per patient: Predicted effect percent
Primary care			
Medicaid price[1]	5.00	0.56	2.80
Medicaid eligibles per physician	−9.66	0.47	−4.54
Private price	11.90	−0.54	−6.43
Physicians per private population	2.37	1.08	2.56
Combined effect	—	—	−5.61
Surgery			
Medicaid price[1]	5.00	0.92	4.60
Medicaid eligibles per physician	−9.66	0.40	−3.86
Private price	11.90	−0.37	−4.40
Physicians per private population	2.37	0.01	0.02
Combined effect	—	—	−3.64

[1] Information on rate of change of Medicaid prices is unavailable. We have assumed a rate of increase of 5 percent per year, based on information that some States updated physician fee profiles and others reduced or froze fees.

SOURCES: U.S. Bureau of the Census: *Statistical Abstract, 1984.* Washington. U.S. Government Printing Office, 1984; American Medical Association: *Physician Characteristics and Distribution in the U.S.* Chicago. American Medical Association; *Economic Report of the President.* Washington. U.S. Government Printing Office, 1983.

Table 10

Summary of the results for physician participation in Medicaid and physician supply of Medicaid services

Parameter	Conclusions, other things equal
Physician's private price	Higher private prices lead to fewer physicians participating in the Medicaid program and a smaller supply of services to the program by participating physicians. Consequently, increases in private physician fees lead to lower Medicaid costs for physician services.
Medicaid price	Higher Medicaid fees lead to higher rates of participation and higher levels of supply to the Medicaid program. Quantitatively, the magnitude of the effects differ between specialities. The effect of Medicaid prices on participation rates is smaller for primary care than for surgery. The effect on the supply of services by participants is fairly large, with somewhat higher elasticities for surgeons than for primary care physicians.
Medicaid eligibles	More Medicaid eligibles in the physician's catchment area increases the physician's supply of services to Medicaid. Conversely, decreases in eligibility lead to program cost decreases.
Physician supply	More physicians per private patient lead to a greater supply of services to the Medicaid program. Projected growth in the physician supply—although it can be expected to lead to lower program costs for a given level of services—will increase total program costs through its effect on the total amount of services supplied to Medicaid patients.

services are shown in summary form in Table 10.

Undoubtedly the most important results are that physicians, on average, respond to prices in a predictable and rational fashion. Two prices are relevant. The first is the private price, and the second is the Medicaid price. As private prices increase, physicians are less willing to participate in Medicaid. However, as Medicaid prices increase, physicians are more willing to participate in Medicaid. The direction of these price effects is important; so too is their magnitude. Our results suggest that physicians' response to both prices are quite elastic, with parameter estimates being consistently greater than 0.5 (at which point a 10-percent increase in fees implies a 5-percent increase in the rate of participation).

Physician response to prices can be divided into two separate decisions. The first is whether or not to participate in the Medicaid program; the second is how many services to supply given the decision to participate. Our empirical estimates suggest that the latter decisions are probably the more important quantitatively. In other words, higher Medicaid fees lead to a greater supply of services to the Medicaid program primarily through more output per participating physician rather than through higher participation rates.

These results are relatively robust and insensitive to the particular specification or techniques employed. It should also be noted that they are not apparent in the raw data; only when multivariate statistical techniques are employed to separate the

effects of different variables do these patterns emerge. This is important because some observers, relying primarily on examination of gross data, have improperly concluded that there is no physician response to fee changes.

Although the results regarding physician supply choices are fairly straightforward, the results on RVU's per Medicaid patient are more difficult to interpret. Higher Medicaid prices generally, but not always, lead to lower RVU's per patient seen. One possible explanation of this phenomenon is that higher Medicaid fees lead to increases in the availability of physicians (both new and existing participants) willing to treat Medicaid patients. Consequently, patient access increases and less ill patients requiring fewer RVU's per visit come into the medical system.[5]

Whether the social value of the increased availability and medical care use associated with higher Medicaid fees is worth the increased program costs cannot be answered by this analysis. Answers to such questions depend on the systemwide effects of physician fee schedule changes, such as effects on hospital use, as well as on the value that patients and society as a whole place on access to and use of medical care.

[5] It has been shown that as Medicaid fees are increased, the proportion of Medicaid *eligibles* who become *participants* increases (Held, 1984).

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