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Physician fees and procedure intensity: the case of cesarean delivery

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Abstract

While there is a large literature investigating the response of treatment intensity to Medicare reimbursement differentials, there is much less work on this question for the Medicaid program. The answers for Medicare may not apply in the Medicaid context, since a smaller share of a physician's patients will be Medicaid insured, so that income effects from fee changes may be dominated by substitution effects. We investigate the effect of Medicaid fee differentials on the use of cesarean delivery over the period 1988–1992. We find, in contrast to the backward-bending supply curve implied by the Medicare literature, that larger fee differentials between cesarean and normal childbirth for the Medicaid program leads to higher cesarean delivery rates. In particular, we find that the lower fee differentials between cesarean and normal childbirth under the Medicaid program than under private insurance can explain between one half and three-quarters of the difference between Medicaid and private cesarean delivery rates. Our results suggest that Medicaid reimbursement reductions can cause real reductions in the intensity with which Medicaid patients are treated. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

A major topic of public policy concern in the U.S. in recent years has been the rapid growth in the expenditures of the major public insurance programs, Medicaid and Medicare. Medicaid, which provides health insurance to low income women and children, disabled, and elderly, has grown by almost 400% over the past decade, with total state and federal expenditures of US$148 billion in 1996. Medicare, which provides universal coverage to the elderly, has grown by 250%, with expenditures of US$203 billion in 1996. These two programs now amount to 18% of the federal budget, and have accounted for 30% of the growth in the budget over the past decade. [1] As a result, there is enormous pressure to rein in program costs. But doing so through channels such as restricted eligibility or reduced beneficiary benefits has run into considerable political difficulty. Instead, much of the attention to cost control in these programs has focused on provider reimbursement, for example through reducing physician fees.

In theory, cutting fees to physicians is a simple mechanism for controlling costs. In practice, behavioral responses by physicians render this a much more difficult proposition than simple static analysis would imply. On the one hand, there is concern that lowering fees might lead to deterioration in quality of care for the publicly insured. On the other hand, there is also concern about physician 'induced demand', whereby providers may make up a large share of fee reductions through increased volume, limiting any cost savings from reductions in fees.

In fact, there are enormous health care literatures on the consequences of fee changes in these two programs. But these literatures have had quite different focuses. The literature on Medicare has focused on the effect of fee changes on the quality of care, and it has largely concluded that lowering fees will raise treatment intensity; as a result, estimates of the savings to the government from fee reductions include an offset for induced demand responses. The literature on Medicaid, on the other hand, has focused on patient access, assessing whether reductions in fees may lead providers to avoid potential Medicaid patients. But there has been remarkably little work on the effect of reduced Medicaid fees on the quality of care of Medicaid patients, conditional on gaining access to the system.

It is therefore tempting to apply the induced demand findings of the Medicare literature to estimate the effects of fee changes in the Medicaid program. In fact, however, there is reason to believe that the evidence from the Medicare program may not apply to the case of Medicaid. The reason emerges from the basic economics of physician behavior. In a standard model such as that of McGuire and

[1] Health Care Financing Administration, 1997 (www.hcfa.gov).

Pauly (1991), fee changes will have both income and substitution effects on physicians. As McGuire and Pauly point out, the induced demand hypothesis is simply the implication of a model where income effects dominate substitution effects. This may be a relevant concern in the Medicare program, since treatment of Medicare patients is often performed by physicians who specialize in the Medicare population. But we present data showing that Medicaid patients are a smaller share of a physician's patient pool, so that income effects will be less important. In this context, it is therefore possible that substitution effects will dominate, so that lowering fees will lower treatment intensity.

We investigate this issue within the context of a particular example, cesarean section delivery of childbirth. Cesarean delivery is a particularly useful example because the underlying costs of the procedure in terms of physician time and intensity are considered to be similar to the alternative, vaginal birth, yet reimbursement has traditionally been higher. [2] Moreover, there is tremendous variation across state Medicaid programs in the reimbursement of cesarean delivery. In this paper we consider the effect of variations in this differential on the likelihood of cesarean delivery for the Medicaid population.

In particular, we use discharge abstract data on Medicaid-paid births from nine states over the period 1988–1992 to model the effect of the cesarean reimbursement differential on substitution towards cesarean delivery in the Medicaid population. We match to these data information on Medicaid fee differentials, and we estimate the effect of these differentials on the mode of delivery for childbirth. We find that, on net, there is a strong positive effect of fee differentials on use of cesarean delivery, in contrast to the induced demand findings of the Medicare literature. We estimate that a US$100 increase in the absolute differential between cesarean and vaginal delivery reimbursement increases the cesarean delivery rate in the Medicaid population by 0.7 percentage points. We also find that the lower fee differentials between cesarean and normal childbirth under the Medicaid program than under private insurance can explain between one-half and three-quarters of the difference between Medicaid and private cesarean delivery rates. This finding suggests that cutting reimbursement for cesarean delivery under Medicaid lowers the intensity of treatment of childbirth.

Our paper proceeds as follows. Section 2 sets up a simple model of physician behavior which provides the framework for integrating the previous views. Section 3 reviews the previous literature on physician behavior. Section 4 presents our data and estimation strategy, and our results are presented in Section 5. Section 6 concludes.

[2] The 1993 revision of the resource-based relative value scale (RBRVS), which measures physician workload by the product of intensity and time, concluded that the workload for vaginal delivery is actually higher than that of cesarean delivery (Keeler and Brodie, 1993). Of course, there are other important considerations such as liability and riskiness that may differ across the delivery modes.

2. Theory

We begin our analysis with a brief theoretical formulation of the physician intensity decision. Our analysis closely follows the models of McGuire and Pauly (1991) and Gruber and Owings (1996). Our goal here is to highlight the ambiguous prediction for the effect of fee changes on treatment intensity, and to focus on the relative role of income and substitution effects.

The physician obtains utility from income, but disutility from inducement. His separable utility function has the form:

$$U(Y,I) = U(Y) + U(I) \tag{i}$$

where Y is income and I is total inducement. We make the standard assumptions on the physician's utility function: $U_Y > 0$, $U_I < 0$, U_{YY}, $U_{II} < 0$. Y is defined as

$$\begin{aligned} Y &= B\{1 - a(i)\}Y_n + Ba(i)Y_c \\ Y &= BY_n + Ba(i)m \end{aligned} \tag{ii}$$

where B is the total number of births, $a(i)$ is the share of total deliveries which are by cesarean as a function of inducement per birth i, and m is equal to the difference between the income from a cesarean versus the income from a natural delivery, $m = Y_c - Y_n$. m is a non-negative number throughout our sample period.

We posit $a'(i) > 0$ and $a''(i) = 0$. Since inducement has no natural units, we define the $a(i)$ as linear in i. We can think of $a(0)$ as equal to some p which has the interpretation as cesarean rate if there were no inducement at all, i.e., the clinically necessary cesarean rate. I, defined as total inducement, is equal to

$$I = Bi, \tag{iii}$$

total number of births times inducement per birth.

If we maximize Eq. (i), the first-order conditions with respect to inducement per birth, i, gives us the following:

$$\frac{\mathrm{d}U}{\mathrm{d}i} = U_Y a'(i^*)m + U_I = 0 \tag{iv}$$

i^* being the optimally chosen level of inducement per birth. If we fully differentiate the first-order condition with respect to m, the difference in cesarean and natural delivery reimbursement, we get the following result:

$$\frac{\mathrm{d}i^*}{\mathrm{d}m} = \frac{-U_{YY}aa'(i^*)m - U_Y\dfrac{a'(i^*)}{B}}{U_{YY}(a'(i^*)m)^2 + U_{II}} \tag{v}$$

Since the second derivatives with respect to both income and inducement are negative, the denominator is strictly less than zero. The first term on the numerator above is positive, and the second term is negative. Hence, the sign of the equation above is ambiguous. However, upon taking a closer look, Eq. (v) clearly separates the income and substitution effects associated with the fee change. The U_Y term in the numerator represents the substitution effect while the U_{YY} term represents the income effect. When substitution effects dominate, then $\mathrm{d}i^*/\mathrm{d}m > 0$, and an increase in the differential leads to greater inducement, and hence more cesareans. When income effects dominate $\mathrm{d}i^*/\mathrm{d}m < 0$, and an increase in the fee differential leads to fewer cesareans.

3. Previous literature

3.1. Physician fees and treatment intensity

There is a sizeable health economics literature on the effects of fee changes on procedure intensity. [3] Much of this work has centered on a 'natural experiment' from Colorado in 1977. Prior to that year, prevailing Medicare charges were calculated separately in each of the ten areas of Colorado, and were substantially higher in urban areas of the state. In 1977, the payment system was changed so that charges for calculated for the state as a whole, resulting in a large increase in fees for nonurban physicians, with a freeze for urban physicians. In a series of articles, Rice (1983, 1984) found a strong negative relationship between fee levels and treatment intensity, for surgical, medical, and ancillary services. This finding was confirmed by Christensen (1992), who reanalyzed the Colorado data and estimated an overall elasticity of -0.5 for volume with respect to fees. Thus, the evidence from the Colorado experience is strongly supportive of a backward bending supply curve for physician services.

Other evidence provides a more mixed picture. Escarce (1993) and Yip (1998) studied the effect of reduced reimbursement for 'overpriced' medical procedures under Medicare through the 1987 OBRA legislation. Escarce finds no clear pattern across surgical specialties in the relationship between fees and treatment intensity. Yip performs a detailed study across physician subgroups and finds a mixture of results depending on the particular specialty group. For example, in the market for coronary artery bypass grafting (CABG), the large reduction in Medicare fees for thoracic surgeons led not only to a large increase in CABGs performed in the Medicare population, but there were significant spillover effects into the private sector leading to a higher CABG rate among the privately insured. However, in markets involving other specialty groups—general surgeons, orthopedic surgeons, and urologists—she does not find this same strong within-sector income effect or additional spillover effect as she finds in thoracic surgeon population. This mixed

[3] This is only one strand of the general 'induced demand' literature. There are a number of other studies which consider the effect of direct changes in demand for physician services, for example through changes in surgeon density. See, for example, Fuchs (1978) or Cromwell and Mitchell (1986); for criticisms of this approach, see Phelps (1986) or Dranove and Wehner (1996).

evidence is also reflected in the study of physician fees and treatment intensity in Ontario made by Hurley et al. (1990). They examine physician responses to fee changes for 28 procedures, and find significant physician responses in 10 of them. Of these ten, seven support a negative relationship between fee levels and treatment intensity while the other three support a positive relationship.

Another source of evidence is fee controls, in the U.S. and abroad. Wedig et al. (1989) examine the quantity response of physicians in Alabama, Connecticut, Washington and Wisconsin to the Medicare fee freeze from July 1984 to May 1986. During this time interval, Medicare payments as well as the amount physicians were permitted to balance-bill patients were also frozen at July 1984 levels. They find that the dollar value of services per Medicare beneficiary increased about US$24 from Q3 1984 to Q4 1986 (a 21% increase) while physicians per capita increased only 1.6%. Taken together, these figures imply that quantity per physician rose nearly 20% during the fee freeze. Such rapid output growth per physician under the fee control is consistent with demand inducement. Rice and Labelle (1989) perform a similar analysis on fee controls for nine Canadian provinces over the period from 1975 to 1985. In four of the nine provinces, real unit fees decreased. However, activity per physician increased substantially in those four provinces, such that only two of the four experienced a decline in total billings. The other two experienced quantity increases which more than offset the reduction in fees. Rice and Labelle interpret this finding that physicians can, and do, generate demand in response to real fee reductions in order to maintain their pre-reduction level of income. Feldman and Sloan (1988) also look at Canadian data (but from an earlier period) and find contrasting evidence. They arrive at what they consider conclusive evidence that fee controls worked. Fees were controlled under the universal health insurance plans introduced during the late 1960s and early 1970s. National Physician expenditures as a percentage of GNP was 1.21% in 1970, 1.16% in 1975 and 1.10% in 1980. Overall, Feldman and Sloan argue that there is little evidence for demand inducement in primary care physician services, and if demand inducement does indeed exist in markets for surgical services, it is less severe than previously thought.

This literature has focused primarily on the Medicare program, or on national fee controls. There has been little work on the effect of Medicaid fees on treatment intensity. Instead, most of the work on Medicaid has focused on the effects of fees on access to care, through inducing provider participation in the program. Beginning with the work of Sloan et al. (1978) and Hadley (1979), and continuing through Held and Holahan (1985), Mitchell (1991), and Adams (1994), many researchers documented a strong correlation between higher (relative to Medicare or private payers) Medicaid fees and access to care. [4] But the only paper of which

[4] Although recent work has found a significantly weaker relationship; see Decker (1994) or Baker and Royalty (1996).

we are aware that directly focuses on the relationship between Medicaid fees and treatment intensity is Decker (1994), who finds that physicians spend more time with their Medicaid patients when fees increase.

Can the results from the Medicare program, or from national fee controls, necessarily be applied to the case of Medicaid? We would argue that they may not be applicable, for a simple reason: physicians are much less specialized in Medicaid than they are in Medicare (and certainly less than in the case of national fee controls, which affect all treatment). According to our data, the median physician who performs a surgical procedure on a Medicare patient derives over 60% of his caseload from Medicare. In contrast, for the median physicians who delivers Medicaid babies, only 32% of his caseload comes from the Medicaid program. [5] Thus while a single-payer model may be a reasonable way to model the effects of Medicare fee changes (since physicians who perform Medicare procedures often work primarily in the Medicare sector), modelling Medicaid fee changes requires a multiple-payer framework.

McGuire and Pauly introduce an additional payer into their single-payer model, and the effect of a fee reduction from payer x on the intensity of treatment in sector x is largely similar to the single-payer model. However, there is one important distinction: To the extent that income from sector x represents a smaller and smaller fraction of total income, the income effect becomes less potent. Thus in general the likelihood of physicians responding to fee reductions from a given payer x with increased quantity of services to that sector x is mitigated as the share of total income coming from payer x declines. Given these facts, it may be that while income effects dominate in the case of Medicare, substitution effects dominate in the case of Medicaid. As a result, even as Medicare fee reductions lead to increased intensity of treatment, Medicaid fee reductions may lead to reduced intensity, since income effects are small on average for physicians seeing Medicaid patients.

3.2. Financial incentives and cesarean delivery

There is a separate, and sizeable, literature that focuses specifically on the cesarean section delivery decision. The first type of study focuses on differences in cesarean utilization across payer types. Historically, the financial incentive to perform a cesarean has been greatest among the privately insured, less so among the publicly insured, and least prevalent among the uninsured. The 1989 average

[5] These calculations are based on the roughly 20% subsample of observations in our data for whom physician identifier data are available. This may not be a random subsample, and we are unable in some cases to distinguish individual physicians from physician groups, so these figures should be taken as suggestive only.

differential in fees for was US$561 for the privately insured, and only US$127 for Medicaid population; for the uninsured, the likelihood that the physician bill will not be paid at all whether a cesarean is performed or not renders an almost negligible financial bias towards cesareans. Stafford (1987) examines cesarean rates by payment source in a sample of California hospitals, and he finds results that are consistent with the financial incentives outlined above—cesarean rates are higher for the privately insured than for Medicaid patients. Other studies have looked to declining fertility rates and increased ob/gyn density as possible explanation for higher incidence of cesarean delivery. Tussing and Wojotowycz (1992), examining New York data, finds no correlation between ob/gyn density and cesarean delivery rates. However, such a study suffers from the possibility that omitted regional differences are correlated both with higher ob/gyn density and cesarean utilization. Gruber and Owings (1996) study the effect of declining fertility in the United States. Fertility fell by 13.5% during the 1970–1982 period and cesarean utilization increased by over 240% in the same period. They posit that this decline increased the income pressure on physicians leading them to substitute the more highly reimbursed cesarean delivery. Their primary result is that a within-state 10% decline in the fertility rate is associate with a within-state 0.97 percentage point increase in the cesarean rate. While their results are significant, only 16–32% of the total increase in cesarean usage can be explained by this income shock.

Recent work by Keeler and Fok (1996) is closely related to our work. They study the impact of an insurance reform under California Blue Cross that equalized fees for vaginal and cesarean delivery, a relative decline in cesarean fees of 21%. Using data from before and after the reform, the authors find only a modest 0.7% reduction in cesarean delivery rates, which appears to indicate little intensity response to fee changes. The authors report that this reflects similar experiences with fee changes under Blue Cross plans elsewhere.

These results do not necessarily have predictive power for the effects of Medicaid fee changes. Our reasoning is analogous to the argument set forth earlier on why physician responses to Medicaid fee changes may go in the opposite direction from Medicare fee changes. The primary difference in the two samples is that the average physician in Keeler and Fok’s sample may be getting a substantial proportion of his income from the Health Plan that implemented the fee changes. However, the average ob/gyn in our sample receives a relatively small proportion of his income from Medicaid births. That is, the income effect should be much larger in their sample, since this is a fee reduction for a larger share of their business.

4. Data and empirical strategy

Our primary source of data for this analysis is the Healthcare Access and Utilization Project (HCUP) data, collected by the Agency for Health Care Policy and Research (AHCPR). This survey collects information from a random sample of discharges across eleven states, over the 1988–1992 period. [6] Hospitals are sampled randomly in these states, along five strata, to represent the universe of community-based hospitals in the U.S. The strata are: geographic region; ownership; location; teaching status; and bed size. For each discharge, the survey collects information on source of payment, patient demographics, hospital characteristics, diagnoses, and procedures. Our sample is all Medicaid discharges who were admitted to the hospital with a diagnoses of childbirth.

We match to these data information on Medicaid reimbursement of vaginal and cesarean childbirth. These data come from several sources. For 1988 and 1992, we use data provided by the American College of Obstetricians and Gynecologists (ACOG). For 1989, we use data from PPRC (1991); we also use these data to supplement missing values in 1988. For 1990, we use data from Holahan (1993), supplemented by additional information from ACOG. For 1991, we use data from Singh et al. (1993). [7]

We use these data to run logit regressions of the form:

$$\mathrm{CSEC}_{ijst} = f\left(a + \beta_1 \mathrm{FEEDIFF}_{jst} + \beta_2 X_{ijst} + \beta_3 Z_{jst} + \beta_4 d_s + \beta_5 t_t + \varepsilon_{ijst}\right) \tag{vi}$$

where i indexes individuals, j indexes hospitals, s indexes states, and t indexes years. CSEC is a dummy for cesarean section delivery; FEEDIFF is the differential for cesarean delivery (relative to vaginal); X is a set of individual characteristics; Z is a set of hospital characteristics; d_s is a complete set of state dummies; t_t is a complete set of year dummies.

In this model, we estimate the effect of fee differentials on the odds of cesarean delivery. The fee differential is measured in two ways. First, we simply use the dollar differential between the cesarean and vaginal reimbursement rates (m in our model above). While this follows naturally from the theory presented in Section 2, there is a drawback in that it may not be properly capturing the financial incentive to physicians. The reason is that the theory as presented assumes that physicians operate in a single-payer domain. However, as noted above the average ob/gyn receives the majority of his income from non-Medicaid patients. Hence the extent to which physicians will be willing to trade off the disutility of inducement for the utility of income will depend on their alternative income earning prospects. Following the logic of McGuire and Pauly's two payer model, the incentive to

[6] The states are: Arizona, California, Colorado, Florida, Illinois, Iowa, Massachusetts, New Jersey, Pennsylvania, Washington, and Wisconsin. In 1988, data are only available for eight of the states (Arizona, Pennsylvania, and Wisconsin are not included). We do not include Arizona in our analysis, since they do not have a traditional Medicaid program. In addition, Massachusetts was also deleted due to inconsistent fee data; the results are not sensitive to Massachusetts' inclusion.

[7] We are grateful to Susheela Singh for providing us with some unpublished data from that study.

Table 1

(A) Means of dataset

Variable	Mean	Variable	Mean
Cesarean delivery rate	0.178	Age <20	0.246
No. of discharges	22,520.	Age 20–25	0.371
No. of beds	458.	Age 25–30	0.222
Public hospital	0.327	Age 30–35	0.111
Private non-profit hospital	0.620	Arizona	0.021
Private for-profit hospital	0.053	California	0.331
Teaching hospital	0.343	Colorado	0.022
White	0.201	Florida	0.283
Black	0.085	Iowa	0.051
Race missing	0.461	Illinois	0.099
Not white or black	0.252	Massachusetts	0.037
Median income US$0–US$15,000	0.053	New Jersey	0.025
Median income US$15,000–US$20,000	0.173	Pennsylvania	0.044
Median income US$20,000–US$25,000	0.257	Washington	0.027
Median income US$25,000–US$30,000	0.207	Wisconsin	0.059
Median income US$30,000–US$35,000	0.118	Previous cesarean	0.093
Median income US$35,000–US$40,000	0.065		
Median income US$40,000–US$45,000	0.026		
Median income US$45,000+	0.021		
Income missing	0.080		
Breech presentation	0.029		
Maternal distress	0.0001		
Fetal distress	0.094		

(B) Medicaid fee difference, (cesarean fee) − (vaginal fee)

	1988	1989	1990	1991	1992
CA	306	62	0	0	0
CO	72	236	413	440	428
FL	0	0	0	0	0
IA	253.66	254	264	273	273
IL	75	75	150	150	150
NJ	0	109	130	130	130
PA	147	146	147	146	146
WA	62	62	71	201	201
WI	180	180	180	205	192

Table 1 (continued)

(C) Medicaid fee difference divided by private vaginal fee, [(cesarean fee) − (vaginal fee)]/ (private vaginal fee)

	1988	1989	1990	1991	1992
CA	0.15	0.03	0	0	0
CO	0.04	0.12	0.20	0.19	0.17
FL	0	0	0	0	0
IA	0.35	0.33	0.32	0.31	0.28
IL	0.06	0.06	0.11	0.10	0.09
NJ	0	0.04	0.05	0.04	0.04
PA	0.12	0.11	0.11	0.10	0.09
WA	0.04	0.03	0.04	0.09	0.08
WI	0.19	0.19	0.18	0.19	0.17

(A) shows data from the HCUP study and other sources, as described in the text. $N = 365{,}942$.
(B) shows absolute dollar differentials between reimbursement for cesarean delivery and reimbursement for vaginal delivery.
(C) normalizes these differentials by private reimbursement rates for vaginal delivery.

respond to fee changes in sector x with quantity inducement in sector x is dependent on the prospects of recouping that income from the alternative sector. As a result, a given dollar increment may provide less incentive *for Medicaid inducement* in areas with very high reimbursement for privately insured vaginal delivery, since physicians can substitute their time out of Medicaid births into privately insured births. We therefore reestimate the model using the fee differential divided by the reimbursement for a privately insured vaginal delivery as our index for the financial incentive.

We do not have data for private fees by state and year. Hence, in order to construct the denominator of our series, we start with the private fee for vaginal delivery in each state in 1989, which was collected in a survey by PPRC and reported in (Schwartz et al., 1991). We then use state-specific information on annual hospital cost inflation to deflate this figure backwards and inflate it forward in order to derive a figure for each state and year. [8] Unfortunately, no state-specific annual data on physician cost inflation are available. Nationally, hospital costs rose 310% between 1979 and 1992, as compared to a 250% increase for physician costs. Ob/gyn costs, however, may have grown at a more rapid rate than those of other physicians due to the explosion in malpractice insurance costs for this specialty over the 1980s. Hence, hospital cost growth may be a reasonable proxy for growth in ob/gyn costs.

[8] Data on hospital cost inflation are from the American Hospital Association (AHA, various years). We use the change in total hospital expenses per adjusted patient day, which is a weighted average of inpatient days and outpatient visits, where the relative revenue contribution of each is used as weights.

We also control in the estimation for a variety of factors which potentially determine the cesarean decision. We include a vector of characteristics of the woman: dummies for age groups (20–24; 25–29; 30–34; 35–39; 40–44; 45 +); dummies for white, black, or neither; and dummies for median income in the zip code of residence.[9] There are eight possible categories for median income: 0–US$15,000, US$15,000–US$20,000, US$20,000–US$25,000 ... US$40,000–US$45,000, US$45,000 + . We also control for characteristics of the hospital in which the woman gave birth: number of discharges; type of ownership (public or for-profit, with non-profit being the excluded group); and teaching status (whether the hospital is a member of the Council of Teaching Hospitals).

In addition, we include a full set of year dummies, to control for underlying trends in the cesarean delivery rate. And we include a full set of state dummies as well, to control for secular differences in the rate of cesarean delivery across the states in our sample. With state dummies included in the model, our estimates are identified by within-state changes in fees over time; as we note below, these within-state changes are sizeable.

While we estimate our model at the level of the individual birth, our key regressor (Medicaid fees or the fee ratio) varies only at the state/year level. As a result, it is appropriate to adjust the standard errors for within-state–year clustering. We do so for all estimates below.

The means of our data set are presented in Table 1A. The cesarean delivery rate was 17.8% for these Medicaid women in our sample period, in contrast to 22.5% in the private sector. Roughly 10% of the women had a previous cesarean, and the various measures of ‘complicated birth’ are each present less than 10% of the time. Most (62%) deliveries occurred in private, non-profit hospitals with very few coming in private, for-profit hospitals. Our data are reasonably evenly distributed across the time period, but over 60% are concentrated in two states: California and Florida.

Table 1B shows the Medicaid fee differential between cesarean and natural delivery across states from 1988–1992. There is a substantial amount of variation both across states and time—it reaches as high as US$440 in Colorado for 1991, to as little as US$0 for Florida throughout our sample period (other state-year pairs also exhibit zero differential). All states with the exception of Florida and Pennsylvania exhibited non-trivial variation across time. In particular, California’s absolute differential fell from US$306 in 1988 to 0 by 1990; Colorado’s differential rose from US$72 in 1988 to US$413 in 1990; and Illinois’ differential rose from US$75 in 1989 to US$207 in 1992. For the nation as a whole, the 1989 private fee differential was US$561 on average versus US$127 for the Medicaid

[9] For both race and income, the excluded group is those with missing data: 46.1% of our sample does not have recorded information on race, and 8% does not have recorded information on income.

Table 2
Logit regression result (dependent variable is a dummy for cesarean delivery)

	(1)	(2)	(3)	(4)
Age 20–25	−0.035 (0.0132)	−0.035 (0.0132)	−0.011 (0.0150)	−0.011 (0.0150)
Age 25–30	0.022 (0.0173)	0.022 (0.0173)	0.038 (0.0182)	0.038 (0.0182)
Age 30–35	0.115 (0.0206)	0.115 (0.0207)	0.101 (0.0232)	0.101 (0.0232)
Age 35–40	0.353 (0.0297)	0.353 (0.0297)	0.335 (0.0300)	0.335 (0.0300)
Age 40–45	0.559 (0.0442)	0.559 (0.0442)	0.587 (0.0544)	0.587 (0.0544)
Age 45+	0.546 (0.1790)	0.545 (0.1788)	0.674 (0.186)	0.673 (0.186)
White	−0.041 (0.0281)	−0.046 (0.0274)	−0.003 (0.0296)	−0.008 (0.0307)
Black	−0.109 (0.0495)	−0.114 (0.0515)	−0.050 (0.0603)	−0.056 (0.0632)
Not white or black	−0.155 (0.0402)	−0.160 (0.0384)	−0.071 (0.0394)	−0.077 (0.0386)
Teaching hospital	−0.243 (0.0526)	−0.243 (0.0525)	−0.439 (0.0825)	−0.439 (0.0824)
Private, for profit	0.081 (0.0456)	0.081 (0.0457)	0.129 (0.0546)	0.129 (0.0547)
Public	0.102 (0.0424)	0.103 (0.0423)	0.122 (0.0571)	0.123 (0.0571)
No. of discharges	0.000 (0.0000)	0.000 (0.0000)	0.000 (0.0000)	0.000 (0.0000)
Median income US$0–US$15,000	−0.115 (0.0471)	−0.115 (0.0472)	−0.069 (0.0507)	−0.069 (0.0508)
Median income US$15,000–US$20,000	−0.046 (0.0346)	−0.046 (0.0347)	−0.037 (0.0352)	−0.038 (0.0353)
Median income US$20,000–US$25,000	−0.019 (0.0291)	−0.019 (0.0293)	0.000 (0.0360)	0.000 (0.0362)
Median income US$25,000–US$30,000	0.042 (0.0286)	0.041 (0.0287)	0.047 (0.0296)	0.046 (0.0297)
Median income US$30,000–US$35,000	0.050 (0.0325)	0.049 (0.0326)	0.072 (0.0323)	0.071 (0.0325)
Median income US$35,000–US$40,000	0.062 (0.0309)	0.061 (0.0319)	0.092 (0.0275)	0.091 (0.0277)
Median income US$40,000–US$45,000	0.082 (0.0338)	0.081 (0.0339)	0.063 (0.0377)	0.062 (0.0378)
Median income US$45,000+	0.058 (0.0488)	0.058 (0.0491)	0.079 (0.0527)	0.078 (0.0531)
Previous cesarean	2.973 (0.0543)	2.973 (0.0543)	3.360 (0.0614)	3.360 (0.0614)
Breech presentation			3.720 (0.0448)	3.720 (0.0448)
Maternal distress			1.035 (0.3382)	1.033 (0.3378)
Fetal distress			1.821 (0.0394)	1.821 (0.0395)
Fee differential (US$100s)	0.0494 (0.0123)		0.0654 (0.0150)	
Fee differential normalized by private vaginal fee		1.024 (0.2616)		1.316 (0.3366)

Standard errors are in parentheses. All regressions include a full set of state and year dummies, and are estimated by logit. $N = 365{,}942$. Robust standard errors calculated with data clustered by state/year.

program—this US$434 difference amounts to 29% of the average private vaginal fee in 1989.

Beneath it Table 1C shows the fee differential divided by the private vaginal delivery reimbursement. As aforementioned, the purpose here is to show that the 'magnitude' of the financial incentive goes beyond simple dollar differences for Medicaid deliveries and takes into account alternative means an ob/gyn has to recoup income lost from Medicaid patients. The distinction between these two measures of financial incentives is apparent when looking at California and Iowa data for 1988. The absolute fee difference is US$50 higher in California, which might lead one to believe the financial incentive is stronger in California for cesarean. However, when divided by the private fee, the Iowa measure turns out to be more than twice as large (0.35 versus 0.15). Hence the incentive to induce may be stronger in Iowa because of lower alternative income sources.

5. Basic results

Our basic findings are shown in Table 2, which presents logit estimation of Eq. (vi). These coeffecients can be interpreted by multiplying them by $p.(1-p)$, which is $0.146 +$ our sample mean. We use the absolute fee in columns (1) and (3), expressed in hundreds of dollars, and the normalized (by private fees) fee in columns (2) and (4). In contrast to the Medicare literature, we find a highly significant positive coefficient on the fee differential, either specified as absolute dollars, or normalized by the private fee. Specified as absolute dollars, we find that each US$100 dollar increase in fees leads to a 0.7 percentage point, or 3.9%, rise in cesarean delivery rates. Normalizing by private fees, we find that each 10% rise relative to the private vaginal delivery fee leads to a 1.5 percentage point, or 8.4%, rise in cesarean delivery rates.

As noted earlier, in 1989, the national average private fee differential for cesarean delivery was US$561 on average, as compared to US$127 for the Medicaid program; this US$434 differential amounts to 29% of the private vaginal fee in 1989. Our results therefore imply that if the Medicaid program raised its fee differential to the private level, there would be a rise in cesarean delivery rates of 3.04 percentage points (17.1%) to 4.35 percentage points (24.49%). As noted earlier, the cesarean delivery rate for private patients in our sample is 5.7 percentage points higher than the Medicaid rate. Thus, our findings suggest that raising the Medicaid fee differential to the private sector level would reduce the gap in cesarean delivery rates by between 53% and 76%. That is, the majority of the difference in cesarean delivery rates between private sector and Medicaid patients could be explained by fee differentials.

The control variables are generally significant as well. We find a strong pattern of increasing cesarean delivery rates with age. Cesarean section rates are lower for all those with reported race relative to those with unreported race (the omitted race category), but they are highest for whites, lower for blacks, and even lower for other non-whites. Cesarean delivery rates are lower at teaching hospitals; this is consistent with evidence from New York State in (Tussing and Wojotowycz, 1992). They are also higher at for-profit hospitals, relative to non-profits, which is consistent with the findings of a number of papers, including Gruber and Owings (1996). Surprisingly, however, they are lower at large hospitals and higher at government hospitals; both of these findings are at odds with the previous literature. One reason may be that previous estimates have either used the privately insured, or all patients from an era when Medicaid represented a smaller share of births. Factors which cause high cesarean rates among the privately insured population may not apply to the Medicaid population.

We find that the odds of cesarean delivery rise with median income of the patient's zip code as well. This may be driven by the fact that physicians who operate in wealthier areas have an increased predilection to conducting cesareans. There are generally more privately insured patients in the more affluent zip codes, and the higher cesarean rate among the privately insured may spill over to greater cesarean incidence among Medicaid mothers. Finally, there is a very strong correlation between cesarean delivery and previous cesarean birth, as in previous work. It is common medical practice to have subsequent deliveries to a cesarean birth also be cesarean.

5.1. Alternative explanation: endogenous fees

We find these results to provide striking evidence that higher fee differentials under Medicaid lead to higher cesarean delivery rates. An alternative explanation for this finding, however, is that higher fee differentials are chosen by states when there is high demand for cesarean delivery. This argument loses much of its force once we include state fixed effects in the regression, since it would imply that Medicaid programs react to changes in cesarean demand. Moreover, we have included a rich set of individual characteristics which would capture any demographic or economic shifts correlated with demand for cesareans, for example through the aging of the Medicaid population or changes in the income distribution.

But one natural channel through which this response could occur is fetal or maternal health. There is a clear correlation between cesarean delivery and underlying fetal and maternal health (Gruber and Owings, 1996). It is also possible, although admittedly not likely, that a deterioration in fetal or maternal health which gave rise to more cesarean deliveries could motivate state policymakers to raise the cesarean differential as well.

In order to control for this possibility, we include in the regression three factors which further control the underlying riskiness of the birth: breech presentation, fetal distress and maternal distress. In the United States, more than one in seven women experience complications during labor and delivery arising from either conditions existing prior to pregnancy (i.e., diabetes, hypertension, or infectious diseases) or pathological conditions which develop during pregnancy (i.e., eclampsia or placenta praevia). These problems can be life threatening to the mother and baby, thus cesarean delivery is clinically the safest solution. As columns (3) and (4) in Table 2 show, however, the results on our measures of financial incentives are further strengthened when these additional covariates are inserted. The same US$100 increase in the absolute fee differential leads to a full 1% rise in cesarean delivery rates (as opposed to the earlier 0.7% rise for a US$100 increase). Likewise, a 10% rise relative to the private vaginal fee leads to a 1.9% increase in cesarean delivery rates (as opposed to the earlier 1.5% rise for a US$100 increase). Thus, in this formulation, lower Medicaid fee differentials relative to the private sector can explain up to two-thirds of the differential cesarean delivery rates across sectors.

The coefficients themselves on these severity regressors are also large in magnitude and highly significant. The logit interpretation of the coefficients indicate that the presence of breech presentation increases the likelihood of cesarean by 54%, maternal distress increases likelihood by 15% and fetal distress by 27%. In summary, it appears very unlikely that endogenous fee setting is driving our results.

6. Conclusions

Provider fee policy remains the tool of choice for policy-makers in trying to rein in program costs. As a result, the effect of fees on treatment intensity has received enormous attention in the context of the Medicare literature, but there has been scant attention paid to this question in the context of Medicaid. This is unfortunate, because as we have argued the results for Medicare cannot be naively applied to the case of Medicaid. If the induced demand type results that have been found for Medicare are due to physician income effects, they may apply much less strongly in the Medicaid environment, where a smaller share of a physician's caseload comes from the public insurance program.

Indeed, in contrast to much of the Medicare literature on fees and treatment intensity, we find a positive relationship between the fee differential for cesarean delivery and the rate of cesarean delivery. Our findings suggest that this fee effect is sufficiently large to explain over one half, and up to three-quarters of the differential cesarean delivery rate between the (more highly reimbursed) private sector and Medicaid. One explanation for our finding, relative to the earlier work on fee changes under Medicare in Colorado, is physician income effects. But the Medicare literature has been mixed, and there are a host of differences between our example and the cases studied for Medicare. A resolution of the source of difference between these papers awaits further study.

The welfare implications of our findings are unclear. We have demonstrated that lowering Medicaid fees will lower the rate of cesarean delivery, but we have not provided evidence on whether the marginal cesarean deliveries that are foregone are beneficial for mothers and infants. In fact, the findings of Currie et al. (1995) indicate that raising physician fees under Medicaid causes a significant reduction in infant mortality rates. It is difficult, however, to separate the mechanism through which fees are affecting infant outcomes. Future work on this topic could usefully explore whether the changes in treatment intensity uncovered here have real effects on patient outcomes.

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References

Adams, 1994.

American Hospital Association. Hospital Statistics, various years. AHA, Chicago, IL.

Baker and Royalty, 1996.

Christensen, S., 1992. Volume responses to exogenous changes in medicare's payment policies. Health Services Research 27, 65–79.

Cromwell, J., Mitchell, J., 1986. Physician-induced demand for surgery. Journal of Health Economics 5, 293–313.

Currie, Gruber, Fischer, 1995.

Decker, 1994.

Dranove, Wehner, 1996.

Escarce, J.J., 1993. Effects of lower surgical fees on the use of physician services under medicare. Journal of the American Medical Association 269, 2513–2518.

Feldman, R., Sloan, F., 1988. Competition among physicians, revisited. Journal of Health Politics, Policy and Law 13, 239–261.

Fuchs, V., 1978. The supply of surgeons and the demand for operations. The Journal of Human Resources 13, 35–56.

Gruber, J., Owings, M., 1996. Physician financial incentives and cesarean section delivery. Rand Journal of Economics 27, 99–123.

Hadley, 1979.

Held, Holahan, 1985.

Holahan, 1993.

Hurley, J., Labelle, R., Rice, T. 1990, The relationship between physician fees and the utilization of medical services in Ontario. In: Scheffler, R.M., Rossiter, L.F. (Eds.), Advances in Health Economics and Health Services Research. JAI Press, Greenwich, CT.

Keeler, Brodie, 1993.

Keeler, E., Fok, T., 1996. Equalizing physician fees had little effect on cesarean rates. Medicare Care Research and Review 53, 465–471.

McGuire, T.G., Pauly, M.V., 1991. Physician response to fee changes with multiple payers. Journal of Health Economics 10, 385–410.

Mitchell, 1991.

Phelps, C., 1986. Induced demand—can we ever know its extent?. Journal of Health Economics 5, 355–365.

PPRC, 1991.

Rice, T., 1983. The impact of changing medicare reimbursement rates on physician-induced demand. Medical Care 21, 803–815.

Rice, T., 1984. Physician-induced demand for medical care: new evidence from the medicare program. Advances in Health Economics and Health Services Research 6, 129–160.

Rice, T., Labelle, R.J., 1989. Do physicians induce demand for medical services?. Journal of Health Politics, Policy and Law 14, 587–600.

Schwartz, A., Colby, D., Reisinger, A.L., 1991. Variation in medicaid physician fees. Health Affairs, Spring, 131–139.

Singh et al., 1993.

Sloan, Mitchell, Cromwell, 1978.

Stafford, R.S., 1987. Cesarean section use and source of payment: an analysis of California Hospital rates, 1978–1984. Obstetrics and Gynecology 69, 696–700.

Tussing, A.D., Wojotowycz, M.A., 1992. The cesarean decision in New York State, 1986. Economic and non-economic aspects. Medical Care 30, 529–540.

Wedig, G., Mitchell, J.B., Cromwell, J., 1989. Can price controls induce optimal physician behavior?. Journal of Health Politics, Policy and Law 14, 601–619.

Yip, W.C.M., 1998. Physician Response to Medicare Fee Regulations: Changes in the Volume of Coronary Artery Bypass Graft, Vol. 17. pp. 675–699.