Physician Responses to Financial Incentives: Evidence from Hospital Discharge Records

Kate Ho and Ariel Pakes

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Motivation

- March 2010 health reforms include physician financial incentives to control costs in the Medicare and Medicaid programs
  - Accountable Care Organizations share cost savings
  - Physicians receive bundled payments for episodes including hospitalizations
- Goal: cost control without compromising quality
- Similar cost control incentives currently used by health maintenance organizations (HMOs) for private enrollees in California
- Previous papers document lower costs in HMOs compared to other insurers but not the mechanisms used.

This paper: do patients whose physicians have a financial incentive to control costs receive care at lower-priced hospitals?

Motivation cntd.

- A substantial previous literature uses hospital discharge records to estimate models of hospital choice
- Important for regulatory analysis (e.g. hospital mergers and investment)
  - How much do decision-makers value each hospital?
  - How much would the valuation change after merger/investment?
- But previous papers largely ignore impact of price paid by the insurer to the hospital.

We address this issue. Are hospital choices ever influenced by price paid by insurer to hospital?

Outline

- Overview of the Market and the Model
  - Why should choices respond to hospital prices?
  - How will we estimate price sensitivity?
- The Data
- The Model
  - Multinomial Logit Analysis
  - Inequalities Methodology
- Results and Conclusion

The California Medical Care Market 2003

- Focus on HMOs (53% of employed population)
- 7 largest HMOs had 87% of HMO market: we consider all but Kaiser
- Physician contracts: California Delegated Model dominates
  - HMOs have non-exclusive contracts with large physician groups
- Two payment mechanisms for physician groups
- Capitation payments (fixed pmt per patient to cover services provided): physician groups have incentives to control hospital costs
  - Mechanisms discussed in the paper
- These incentives are passed on to individual physicians
- Alternative: fee-for-service contracts do not generate these incentives.

Implications for Analysis

- We utilize hospital discharge data for California in 2003, focus on women in labor
- Dataset does not identify patients' physician groups or details of compensation schemes
- We observe each patient's HMO and percent of each HMO's payments for primary services that are capitated
- Considerable dispersion across insurers
  - Blue Cross: 38% capitated payments
  - Pacificare: 97% capitated payments

Questions: Are hospital choices influenced by price? Does price matter more when the patient is enrolled in a high-capitation insurer?

Overview of the Model

Estimate utility of patient/insurer/physician agent making hospital choice:

$$W_{i,\pi,h} = \theta_{p,\pi}(price_{i,\pi,h}) + g_\pi(q_h(s), s_i) + \theta_d d(l_i, l_h) + \varepsilon_{i,\pi,h}$$

- $price_{i,\pi,h}$ = price paid by insurer to hospital for patient i's services
- $d(l_i, l_h)$ = distance between hospital and patient's home
- s_i = measure of patient severity
- $q_h(s)$ = vector of perceived qualities for different sickness levels
- $g_\pi(.)$ = flexible function interacting $q_h(s)$ and s_i
  - Permits hospitals to have higher quality for some sickness levels
  - And preferences for quality to differ across severities
  - Ideally would interact every severity group with hospital F.E.s.

Questions: Is the price coefficient negative? Is it more negative when insurer capitates a larger proportion of physicians?

The Dataset

- Hospital discharge data from California 2003 (OSHPD data)
- Census of hospital discharges, private HMO enrollees: women in labor
- Patient characteristics: HMO name, hospital name, diagnoses, procedures, age, gender, zip code, list price
- Hospital characteristics: average discount, zip code, teaching status, number of beds, services, annual profits.

The Price Variable

- Price paid to hospital is unobserved
- Instead: list price (equivalent to hotel "rack rate") and average discount at hospital level
- Calculate expected list price = average list price for ex ante similar patients at the relevant hospital
- Assume (for now) that discount is fixed across insurers
- Define price = expected list price*(1-average discount).

Descriptive Statistics: Discharge Data

	Mean	Std Devn.
Number of patients	88,157	
Number of hospitals	195	
Teaching hospital	0.27	
List price ($)	$13,312	$13,213
List price*(1-discount)	$4,317	$4,596
Length of Stay	2.54	2.39
Died	0.01%	0.004%
Acute Transfer	0.3%	0.02%
Special Nursing Transfer	1.5%	0.04%

Prices and Outcomes By Patient Type

	N	Price*(1-disc)	Acute Transfer	Special Nursing
Age				
<40	84130	4269 (4488)	0.3% (0.0%)	1.49% (0.0%)
>40	4027	5310 (6373)	0.5% (0.1%)	1.54% (0.2%)
Charlson				
0	86326	4276 (4501)	0.3% (0.0%)	1.5% (0.0%)
1	1753	6079 (7060)	0.6% (0.2%)	2.3% (0.4%)
>1	78	10022 (15186)	5.1% (2.5%)	12.8% (3.8%)

Notes: Labor diagnosis only. Charlson score (Charlson et al, 1986, *Journal of Chronic Diseases*): clinical index that assigns weights to comorbidities other than principal diagnosis where higher weight indicates higher severity. Values 0-6 observed in data.

Multinomial Logit Analysis

Equation for estimation:

$$W_{i,\pi,h} = \theta_{p,\pi}(\delta_h lp(c_i, h)) + g_\pi(z_h, x(s_i)) + \theta_d d(l_i, l_h) + \varepsilon_{i,\pi,h}$$

- Define $g_\pi(z_h, x(s_i)) = q_h + \beta z_h x(s_i)$ where
  - q_h: hospital fixed effects, z_h: hospital characteristics
  - $x(s_i)$: P(adverse outcomes | age, diagnosis, Charlson score)

Caveat(s):

- Price endogeneity problems if some unobservable not captured by $g_\pi(.)$ affects choices and is correlated with price.

Results: Logit Analysis 1

	All labor	Least sick	Sickest patients
Price	0.010** (0.002)	-0.017* (0.009)	0.012** (0.002)
Distance	-0.215** (0.001)	-0.215** (0.002)	-0.217** (0.002)
Distance squared	0.001** (0.000)	0.001** (0.000)	0.001** (0.000)
$z_h x_i$ interactions (15 coeffts)	Y	Y	Y
Hospital F.E.s (194 coeffts)	Y	Y	Y
N	88,157	43,742	44,059

Notes: Least sick patients are aged 20-39 with zero Charlson scores and all diagnoses "routine"

Results: Logit Analysis 2

	% capitated	Discharges	Least sick patients Estimates
Price x			
Pacificare	0.97	7,633	-0.077** (0.01)
Aetna	0.91	3,173	-0.011 (0.016)
Health Net	0.80	8,182	-0.038** (0.01)
Cigna	0.75	4,001	-0.021 (0.014)
Blue Shield	0.57	7,992	0.018 (0.011)
Blue Cross	0.38	12,761	0.008 (0.011)
Distance			-0.215** (0.002)
Distance squared			0.001** (0.000)
$z_h x_i$ controls			Y
Hospital F.E.s			Y
N			43,742

Distance elasticity = -2.7; price elasticity (Pacificare) = -0.25

Inequalities Analysis

Econometrician prediction of utility from (i, π, h) is

$$U_{i,\pi,h} = \theta_{p,\pi}(\delta_{\pi,h} lp(c_i, h)) + g_\pi(q_h(s), s_i) + \theta_d d(l_i, l_h)$$

- s_i, c_i much more detailed than logit equivalents
- $g_\pi(q_h(s), s_i)$ interacts severity dummies with hospital F.E.s
- 106 populated groups x 157 hospitals
- Assumption: $g_\pi(.)$ absorbs all unobservables known to decision-maker that affect hospital choice
- Remaining unobservable is measurement error s.t. $E(\varepsilon_{i,\pi,h} \mid I_{i,\pi}) = 0$:

$$W_{i,\pi,h} = \theta_{p,\pi}(\delta_{\pi,h} lp(c_i, h)) + g_\pi(q_h(s), s_i) - d(l_i, l_h) - \varepsilon_{i,\pi,h}$$

Inequalities Analysis, Intuition

Identifying assumption: for every patient i_h, utility from chosen hospital h $>=$ that from any alternative h'

$$W_{i_h,\pi,h} \geq W_{i_h,\pi,h'}$$

Notation:

$$W(i_h, h, h') = W_{i_h,\pi,h} - W_{i_h,\pi,h'} \geq 0.$$

Intuition: find all pairs of same-π, same-s, different-c patients i_h, $i_{h'}$ s.t.:

- i_h visited h and had alternative h'
- $i_{h'}$ visited h' and had alternative h

Sum their inequalities. Equal and opposite $g_\pi(.)$ terms drop out. Take expectations on data-generating process to address $\varepsilon_{i,\pi,h}$.

Inequalities Analysis, Details

Patient i_h and $i_{h'}$ utility differences (noting that $s_{i_h} = s_{i_{h'}} = s$):

$$W(i_h, h, h') = \theta_{p,\pi}.p(i_h, h, h') + g_\pi(q_h, s) - g_\pi(q_{h'}, s) - d(i_h, h, h') - \varepsilon(i_h, h, h') \geq 0$$

$$W(i_{h'}, h', h) = \theta_{p,\pi}.p(i_{h'}, h', h) + g_\pi(q_{h'}, s) - g_\pi(q_h, s) - d(i_{h'}, h', h) - \varepsilon(i_{h'}, h', h) \geq 0$$

Sum expressions; take expectations cndnal on z s.t. $E(\varepsilon \mid z) = 0$:

$$E\ (\ \theta_{p,\pi}(p(i_h, h, h') + p(i_{h'}, h', h)) - (d(i_h, h, h') + d\left(i_{h'}, h', h\right))\ \mid z\ ) \geq 0.$$

Sum inequalities over patients and hospitals for each insurer. Identify set of $\theta_{p,\pi}$ satisfying implied system of inequalities.

Results: Inequalities Analysis

	% capitated	Discharges	$[\theta_{LB},$	$\theta_{UB}]$
Pacificare	0.97	15,479	[-,	-0.74]
Aetna	0.91	6,291	[-,	-1.07]
Health Net	0.80	16,950	[-,	-0.34]
Cigna	0.75	8,097	[2.17,	-]
Blue Shield	0.57	16,302	[-1.26,	4.18]
Blue Cross	0.38	25,038	[-,	2.04]

Results: Inequalities Analysis

Add price instruments:

	% capitated	Discharges	Dist insts $[\theta_{LB},$	$\theta_{UB}]$	Add price insts $[\theta_{LB},$	$\theta_{UB}]$
Pacificare	0.97	15,479	[-,	-0.74]	[-1.62,	-0.74]
Aetna	0.91	6,291	[-,	-1.07]	[-3.60,	-1.07]
Health Net	0.80	16,950	[-,	-0.34]	[-2.05,	-0.34]
Cigna	0.75	8,097	[2.17,	-]	[2.17,	1.50]
Blue Shield	0.57	16,302	[-1.26,	4.18]	[-0.51,	1.38]
Blue Cross	0.38	25,038	[-,	2.04]	[-2.79,	1.44]

Magnitude of Results

Insurer	% cap	Logits (less-sick patients) elasticity	Inequalities (all patients) min. elasticity
Pacificare	0.97	-0.25	-4.11
Health Net	0.80	-0.12	-1.88

- Ineqs: results implied by U.B. of $[\theta_{LB}, \theta_{UB}]$ if logits otherwise correct
- Gaynor and Vogt (2003): price index approach generates average price elasticity of -4.85.

Conclusions

- Objectives:
  - Estimate preferences of the agent that determines hospital choice
  - Identify whether physician incentives affect price sensitivity
- Both methodologies indicate that price affects hospital choice
- Price matters more when insurer capitates a larger proportion of physicians
- Inequalities method allows us to:
  - difference out $g_\pi(.)$ terms, address endogeneity concerns
  - remove assumptions on error term distribution
- More work to do on inequalities analysis
- Results have implications for the impact of the U.S. health reforms on costs and for regulatory analysis more generally.