Willingness to Pay and Healthcare

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Grad IO

Healthcare and IO

In recent years, IO has made inroads into questions related to healthcare:

- How do hospital (systems) and insurers interact?
- What is the value of adding a hospital to an insurer's network?
- What determines the market power of insurers? hospitals?
- Can steering incentives (in network/out of network) be effective in reducing costs?

Today's Reading:

In recent years, IO has made inroads into questions related to healthcare:

- Capps, Dranove, Satterthwaite (2003)
- Ho AER (2009)

CDS(2003): Motivation

The Government keeps losing hospital mergers (basically all of them):

- Some people travel enormous distances to get treatment at hospitals (Mayo Clinic, Cleveland Clinic, Johns Hopkins, Mass General, etc.)
- These cases are lost at the stage of market definition under the hypothetical monopolist test.
    - Recall: SSNIP of 5% price increase for all products. If this is not profitable – include next closest substitute. Continue adding products to define relevant market.
    - Resulting markets are so large (and unconcentrated) that mergers always lead to negligible changes in market power
- What if we could measure relevant markets better?

CDS(2003): Ex-Ante and Ex-Post WTP

What is the value that i places on having hospital j included in network G?

$$\begin{aligned} U_{ij} &= \alpha R_j + H_j' \Gamma X_i + \tau_1 T_{ij} + \tau_2 T_{ij} \cdot X_i + \tau_3 T_{ij} \cdot R_j - \gamma \left(Y_i, Z_i\right) P_j \left(Z_i\right) + \varepsilon_{ij} \\ &= U \left(H_j, X_i, \lambda_i\right) - \gamma \left(X_i\right) P_j \left(Z_i\right) + \varepsilon_{ij} \end{aligned}$$

- $H_j = [R_j, S_j]$ is partitioned into generic R and diagnosis specific S characteristics.
- $X_i = [Y_i, Z_i]$ is partitioned into demographic Y and diagnosis specific Z characteristics.
- $T_{ij} = T_j \left(\lambda_i\right)$ distance from i's home to hospital j
- This paper: ignore $\gamma \left(X_i\right) P_j \left(Z_i\right)$ since $P_{j'}(Z_i) \approx P_j(z_i)$
- Parameters: $[\alpha, \Gamma, \tau]$ and $\gamma(X_i)$.

Deriving WTP

Assume that $\varepsilon_{ij} \sim$ Type I EV:

$$s_j\left(G, X_i, \lambda_i\right) = \frac{\exp\left[U\left(H_j, X_i, \lambda_i\right)\right]}{\sum_{g \in G} \exp\left[U\left(H_g, X_i, \lambda_i\right)\right]}$$

And

$$V^{IU}\left(G, Y_i, Z_i, \lambda_i\right) = E \max_{j \in G}\left[U\left(H_j, Y_i, Z_i, \lambda_i\right) + \varepsilon_{ij}\right] = \ln\left[\sum_{j \in G} \exp\left(U\left(H_j, Y_i, Z_i, \lambda_i\right)\right)\right]$$

Deriving WTP II

What happens to utility when we remove j from the choice set?

- After you know your diagnosis Z_i
- Before you draw your ε_{ij}

$$\begin{aligned}\Delta V_j^{IU}\left(G, Y_i, Z_i, \lambda_i\right) &= V^{IU}\left(G, Y_i, Z_i, \lambda_i\right) - V^{IU}\left(G/j, Y_i, Z_i, \lambda_i\right) \\ &= \left[\frac{1}{1 - s_j\left(H_j, Y_i, Z_i, \lambda_i\right)}\right]\end{aligned}$$

To get dollars we need $\gamma(X_i)$ so that $\Delta W_{ij}^{IU}(G, Y_i, \lambda_i) = \frac{\Delta V_j^{IU}(G, Y_i, Z_i, \lambda_i)}{\gamma(X_i)}$

Ex-Ante WTP

But at the beginning of the year (when you choose insurance) you don't observe Z_i:

$$\Delta W_{ij}^{EA}\left(G, Y_i, \lambda_i\right) = \int_Z \Delta W_j^{IU}\left(G, Y_i, Z_i, \lambda_i\right) f\left(Z_i | Y_i, \lambda_i\right) dZ_i$$
$$= \int_Z \frac{\Delta V_j^{IU}\left(G, Y_i, Z_i, \lambda_i\right)}{\gamma\left(Y_i, Z_i, \right)} f\left(Z_i | Y_i, \lambda_i\right) dZ_i$$

Integrate out (expected) health Z_i conditional on demographics Y_i and location λ_i.

$$\Delta W_j^{EA}(G) = N \int_{y,\lambda} \Delta W_j^{IU}\left(G, Y_i, Z_i, \lambda_i\right) f\left(Y_i | \lambda_i\right) dY_i d\lambda_i$$
$$= N \int_{Y,Z,\lambda} \frac{1}{\gamma\left(Y_i, Z_i\right)} \ln\left[\frac{1}{1 - s_j\left(G, Y_i, Z_i, \lambda_i\right)}\right] f\left(Y_i, Z_i, \lambda_i\right) dY_i dZ_i d\lambda_i$$

Aggregate over N consumers and integrate out heterogeneity in the population.

Insurer's Problem

If the insurer includes hospital j in the network they gain:

$$\pi_j = \alpha \left(\Delta W_j^{EA}(G) - \Delta C_j(G)\right) + u_j$$

- $\Delta W_j^{EA}(G)$ comes from extra willingness to pay of consumers
- $\Delta C_j(G)$ comes from extra costs (could be negative).
- α is assumed to be a fixed constant (share of surplus) $\rightarrow$ bargaining weight.

In Practice

In practice CDS have to cut some corners

- Big problem is that they can't identify $\gamma(X_i)$ and assume $\gamma(X_i) = \gamma_p$.
    - "True" model puts most weight on inelastic consumers who value income little
    - People who are very sick; people who are very rich.
- They assume $\Delta C_j(G) = 0$ so that they can regress

$$\pi_j = \frac{\alpha}{\gamma_P}\left(\overline{\Delta W}_j^{EA}(G)\right) + u_j = a\left(\overline{\Delta W}_j^{EA}(G)\right) + u_j$$

- Probably worry that high quality hospitals are costly ie: $Cov(\xi_j, \omega_j) > 0$ in BLP.

Data

TABLE 3 **Patient Variables (N = 41,083)**

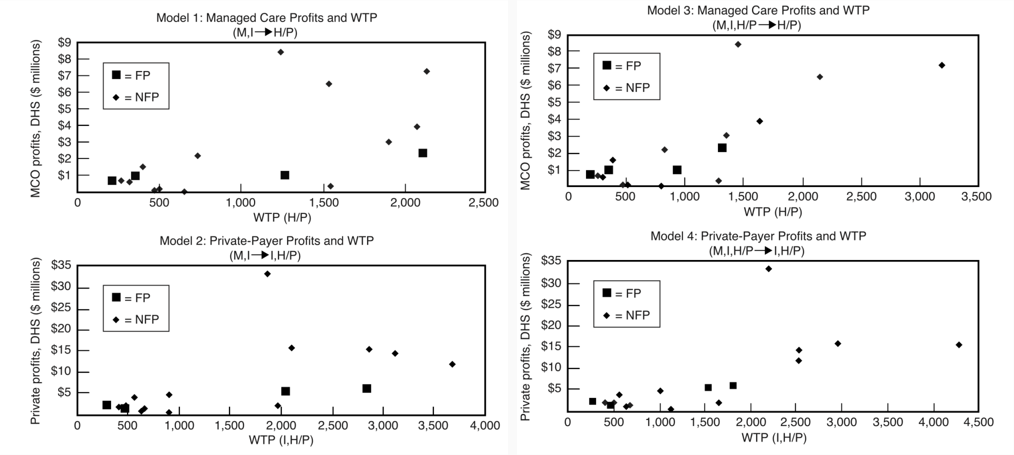
Variable	Type	Mean	Standard Deviation	Minimum	Maximum
Male	Y	.336	.472	0	1
Elderly	Y	.314	.464	0	1
White	Y	.794	.404	0	1
Income, $1,000’s	Y	16,640	5,999	0	40,268
Expected Length of Stay	Y	5.539	7.533	0	415
%Travel (*pcttravel*)	Y	.219	.060	.128	.581
Number of Other Procedures	Y	1.448	1.391	0	4
Number of Other Diagnoses	Y	2.092	1.442	0	4
Driving Time (minutes to chosen hospital)	—	15.801	9.995	1	79
Travel Distance (miles to chosen hospital)	—	8.884	7.525	.3	61.1
Driving Time (minutes to all hospitals)	—	29.346	16.751	1	92
Travel Distance (miles to all hospitals)	—	19.848	13.775	.2	69.3
Medicare Dummy	—	.268	.443	0	1
Blue Cross/Blue Shield Dummy	—	.046	.210	0	1
Indemnity Dummy	—	.206	.405	0	1
HMO/PPO Dummy	—	.479	.500	0	1
Neurological Diagnosis	Z	.031	.174	0	1
Respiratory Diagnosis	Z	.036	.186	0	1
Cardiac Diagnosis	Z	.115	.319	0	1
Labor/Delivery	Z	.285	.452	0	1
MRI/CT Admission	Z	.042	.200	0	1
Psychiatric Admission	Z	.025	.157	0	1

Estimation

1. Estimate individual choice logit via MLE (no endogeneity) on different samples (MCO alone, MCO plus indemnity)
2. Estimate the WTP measure ΔV_j^{IU} (MCO only, MCO+Idemnity) for each hospital.
3. Try to compute cost estimates using admission data.
4. Compute hospital profits using (Revenue - Costs).
5. Regress profits on the WTP measure.

Idea is that high WTP hospitals add more value to network and command more profits.

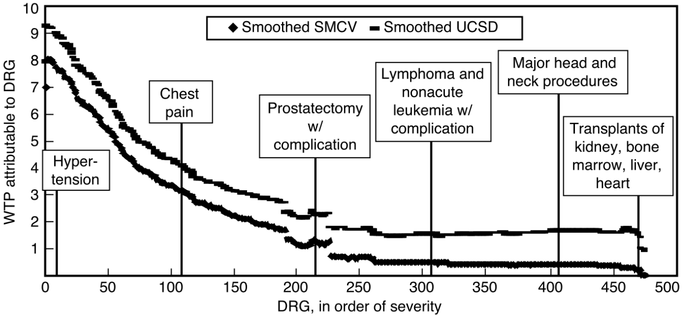
Do not-for profits exploit market power? (Yes)



Decomposing WTP: UCSD vs. SCV

FIGURE 2

ITEMIZATION OF WTP BY DRG FOR UCSD AND SCRIPPS MEMORIAL CHULA VISTA (SCV)



UCSD's value is driven by most severe diagnoses.

What might a merger do?

The merger allows the seller to bundle hospitals

$$\overline{\Delta W}^{EA}_{j+k}(G) = N \int_{Y,Z,\lambda} \ln \left[\frac{1}{1 - s_j\left(G, Y_i, Z_i, \lambda_i\right) - s_k\left(G, Y_i, Z_i, \lambda_i\right)} \right] f\left(Y_i, Z_i, \lambda_i\right) dY_i dZ_i d\lambda_i$$

$$\Delta \hat{\pi}_{j+k} = \hat{a} \left[\overline{\Delta W}^{EA}_{j+k}(G) - \overline{\Delta W}^{EA}_{j}(G) - \overline{\Delta W}^{EA}_{k}(G) \right]$$

Where $\hat{a}$ is the coefficient from regression of profits on WTP.

- Will be largest when products are close substitutes or affect same customers.

Case Study: Chula Vista

- Three hospitals (Scripps: SCV, Community Hospital: CHCV, Paradise Valley (PVH)
- Because 30% of patients leave Chula Vista SSNIP tests tend to say Chula Vista is not its own market.
- But WTP says otherwise

Merger Results

TABLE 6 **Effects of Chula Vista Mergers**

	Model			
Merger	1[a]	2[b]	3[a]	4[b]
Increase in WTP				
SCV and PVH	274.64	33.6	222.84	27.66
SCV and CHCV	59.88	78.05	62.74	82.15
PVH and CHCV	55.7	73.2	47	62.35
All three	422.96	524.38	361.59	453.31
Profit Increase Per Private Discharge				
SCV and PVH	$144.48	$172.68	$126.99	$153.97
SCV and CHCV	$28.94	$41.56	$32.84	$47.64
PVH and CHCV	$77.17	$77.15	$7.53	$71.57
All three	$18.28	$221.19	$166.96	$208.26
Percentage Increase in Profit				
SCV and PVH	8.94%	14.07%	9.36%	14.74%
SCV and CHCV	4.26%	7.23%	4.94%	8.40%
PVH and CHCV	2.23%	3.76%	2.63%	4.41%
All three	12.12%	19.50%	13.30%	21.45%
Percentage Increase in Price				
SCV and PVH	10.97%	12.46%	9.64%	11.11%
SCV and CHCV	1.95%	2.74%	2.22%	3.15%
PVH and CHCV	3.52%	3.65%	3.22%	3.38%
All three	11.39%	13.98%	10.55%	13.16%

[a]Profit computed as $Q^{MCO} AR(Q^{Private}) - AC(Q)Q^{MCO}$.
[b]Profit computed as $Q^{Private} AR(Q^{Private}) - AC(Q)Q^{Private}$.

Merger Results

TABLE 7 Other Mergers (Based on Model-4 Results)

Merger	WTP Gain	% Increase Profit	Patient-Weighted Premerger AR	% Increase in Price	Per Discharge Increase in Private-Pay Profit	Miles (Minutes)	Number Teaching	Number Transplant	Number Delivery
Sharp Memorial [a] and UCSD	463.3	7.15%	27,18.4	3.42%	$93.11	5.2 (10)	2	2	2
Scripp's La Jolla and HCA[b]	233.8	5.78%	2,322.5	5.98%	$106.44	1.5 (3)	1	1	1
San Miguel and Mercy[c]	115.7	2.83%	2,175.9	2.53%	$55.00	1.2 (3)	2	0	1
Paradise and HCA[d]	36.1	1.14%	2,339.7	1.15%	$26.90	19.6 (26)	1	2	1
Villa View and Coronado[e]	17.8	1.35%	2,189.6	1.90%	$41.55	9.9 (22)	0	1	1
Scripps Chula Vista and Mission Bay[f]	4.3	.34%	1,509.1	.17%	$2.54	16.4 (23)	0	0	1

[a] Sharp Memorial and UCSD are near downtown San Diego.
[b] Scripps La Jolla and HCA are a northern satellite-pair.
[c] San Miguel and Mercy are both near downtown San Diego.
[d] Paradise and HCA are on opposite sides of downtown San Diego.
[e] Villa View is in northeast San Diego and Coronado is near downtown.
[f] Scripps and Mission Bay are on opposite sides of downtown San Diego.

Ho AER 2009: Insurer-Provider Networks in the Medical Care Market

Research Question

- How do insurers and healthcare providers (hospitals) divide profits?
- How is the division of profits related to the networks of hospitals offered by insurers?
- Given we know about WTP and demand, how can we treat supply decisions of endogenous networks and negotiations between firms seriously?

Timing of the game

1. Hospitals make price offers to plans
2. Plans choose their hospital networks
3. Plans set premiums
4. Consumers and employers jointly choose plans
5. Sick consumers visit hospitals; plans pay hospitals for services provided

Plan choice of quality and products, together with the hospital's choices of capacity, location, services, and quality are outside the model (exogenous).

Hospital Services

TABLE 4—DEFINITION OF HOSPITAL SERVICES

Cardiac	Imaging	Cancer	Births
1. Cardiac catheterization lab	1. Ultrasound	1. Oncology services	1. Obstetric care
2. Cardiac intensive care	2. CT scans	2. Radiation therapy	2. Birthing room
3. Angioplasty	3. MRI		
4. Open heart surgery	4. SPECT		
	5. PET		

Notes: This table sets out the definition of the hospital service variables summarized in Table 1. Hospitals were rated on a scale from 0 to 1 within four service categories, where 0 indicates that no services within this category are provided by the hospital, and a higher rating indicates that less common (assumed to be higher-tech) service in the category is offered. The categories are cardiac, imaging, cancer, and births. The services included in each category are listed in Table 5. The exact methodology for rating hospitals is as follows. If the hospital provides none of the services, its rating $= 0$. If it provides the least common service, its rating $= 1$. If it offers some service X but not the least common service, its rating $= (1 - x)/(1 - y)$, where x = the percent of hospitals offering service X and y = the percent of hospitals offering the least common service.

Key characteristic: how sophisticated services are for particular diagnoses.

Data: Hospitals

TABLE 1—DESCRIPTIVE STATISTICS FOR HOSPITALS

	Mean	Standard deviation
Number of beds (set up and staffed)	338.66	217.19
Teaching status	0.195	0.397
For-profit	0.202	0.401
Registered nurses per bed	1.263	0.498
Cardiac services	0.812	0.310
Imaging services	0.539	0.287
Cancer services	0.647	0.402
Birth services	0.857	0.348

Notes: $N = 665$ hospitals. Cardiac, imaging, cancer, and birth services refer to four summary variables defined in Table 4. Each hospital is rated on a scale from 0 to 1, where 0 indicates that no procedures in this category are provided by the hospital, and a higher rating indicates that a less common service is offered.

Data: Plans

Table 2—Descriptive Statistics for HMO/POS Plans

Variable	Definition	N	Mean	Standard deviation
Market share	Plan share of nonelderly market	516	0.03	0.04
Premium pmpm ($)	Premiums earned per member per month	478	140.75	44.27
Physicians per 1,000 population	Number of physician contracts per 1,000 population in markets covered by plan	418	1.56	1.51
Breast cancer screening	Percent of women age 52–69 who received a mammogram within last 2 years	352	0.73	0.05
Cervical cancer screening	Percent of adult women who received pap smear within last 3 years	352	0.72	0.07
Check-ups after delivery	Percent of new mothers receiving a check-up withing 8 weeks of delivery	351	0.72	0.11
Eye exams for diabetics	Percent of adult diabetics receiving eye exam within last year	350	0.45	0.11
Adolescent immunization 1	Percent of children receiving all required doses of MMR and Hep B vaccines before 13th birthday	346	0.31	0.16
Adolescent immunization 2	Percent of children receiving all required doses of MMR, Hep B, and VZV vaccines before 13th birthday	313	0.15	0.11
Advice on smoking	Percent of adult smokers advised by physician to quit	213	0.63	0.07
Mental illness checkup	Percent of members seen as outpatient within 30 days of discharge after hospitalization for mental illness	307	0.68	0.15
Care quickly	Composite measure of member satisfaction re: getting care as soon as wanted	304	0.75	0.05
Care needed	Composite measure of member satisfaction re: getting authorizations for needed/desired care	304	0.72	0.06
Age 0–2	Dummy for plans age 0–2 years	516	0.01	0.08
Age 3–5	Dummy for plans age 3–5 years	516	0.06	0.23
Age 6–9	Dummy for plans age 6–9 years	516	0.17	0.37
Aetna	Plan fixed effect	516	0.15	0.36
CIGNA	Plan fixed effect	516	0.10	0.31
Kaiser	Plan fixed effect	516	0.03	0.16
Blue Cross/Blue Shield	Dummy for ownership by BCBS	516	0.16	0.36
POS plan	Dummy for POS plan	516	0.35	0.49

Network Choices

- If all hospitals contract with all plans – we can't tell who has bargaining power.

Category	Definition	Number of markets	Examples
1	The 5 largest plans (by enrollment) contract with all 8 largest hospitals (by number of admissions)	5	San Antonio, TX Atlanta, GA
2	One plan excludes at least one hospital	10	Boston, MA Columbus, OH
3	Two plans exclude at least one hospital or three plans exclude exactly one hospital each	6	Detroit, MI San Francisco, CA
4	Three plans exclude at least one hospital; one of them excludes more than one	13	Houston, TX Miami, FL
5	Four or more plans exclude at least one hospital each	8	Portland, OR New Orleans, LA

Network Choices

TABLE 3—SUMMARY DATA FOR SELECTIVE AND UNSELECTIVE MARKETS

	Unselective markets (category 1 and 2) mean (std dev)	Selective markets (category 4 and 5) mean (std dev)	p-value for difference in means
Market population (million)	2.36 (1.11)	2.36 (1.96)	1.00
Number of HMO/POS plans with over 1 percent market share	6.80 (1.70)	6.57 (1.89)	0.71
Number of hospitals	19.80 (11.40)	21.24 (20.53)	0.78
Beds per 1,000 population	2.78 (1.00)	2.90 (0.99)	0.74
Managed care penetration	0.33 (0.17)	0.35 (0.15)	0.66
Average age of population	34.76 (2.19)	34.31 (1.39)	0.49
Percent of under 65 population age 55–64	0.09 (0.01)	0.09 (0.01)	0.75
Median total family income of population	$48,890 ($8,460)	$46,130 ($8,642)	0.35
Standard deviation of total family income of population	$53,687 ($9,805)	$52,797 ($6,511)	0.76
Mean distance between hospitals (miles)	11.71 (5.60)	13.41 (5.12)	0.36
Standard deviation of distances between hospitals (miles)	7.67** (3.37)	10.30** (4.06)	0.04
Number hospitals with open heart surgery	8.07 (3.67)	10.19 (8.59)	0.31
N	15	21	

**Significant difference in means at the 5 percent level.

Hospital Demand

Plain logit MLE (no random coefficients, no endogeneity)

- Similar to CDS (2003)
- individual i, hospital h and diagnosis l, and market m
- Consumer characteristics $\nu_{i,l}$ (diagnosis, location, etc.)
- $[x_h, \eta_h]$ hospital characteristics (obs, unobs)

$$u_{i,h,l} = \eta_h + x_h \alpha + x_h v_{i,l} \beta + \varepsilon_{i,h,l}$$

$$EU_{i,j,m} = \sum_l p_{i,l} \log \left(\sum_{h \in Hj} \exp \left(\eta_h + x_h \hat{\alpha} + x_h v_{i,l} \hat{\beta} \right) \right)$$

- $p_{i,l}$ is ex-ante probability that consumer i receives diagnosis l.

Hospital Demand Results

Table 5—Relation of Hospital Characteristics to Market Shares

	Coefficient estimate	
Cardiac services	0.732**	0.676**
	(0.104)	(0.072)
Imaging services	0.233**	0.224**
	(0.107)	(0.074)
Cancer services	0.158**	0.299**
	(0.079)	(0.054)
Birth services	0.507**	0.394**
	(0.082)	(0.056)
Teaching hospital	0.243**	0.461**
	(0.074)	(0.051)
Constant	−4.484**	−0.005
	(0.097)	(0.007)
Market FEs?	No	Yes
Adjusted R^2	0.27	0.69

Notes: Regression of the log of hospital market shares on hospital characteristics. $N = 633$ hospitals (the 665 providers in the full dataset less 14 Kaiser hospitals and 18 hospitals in Baltimore, MD, which were excluded from the supply-side analysis). Standard errors are reported in parentheses. Cardiac, imaging, cancer, and birth services refer to the four hospital service variables defined in Table 4.

Plan Demand

Take estimated EU_{ijm} and include as a regressor in another logit for plan choice:

$$\tilde{u}_{i,j,m} = \xi_{j,m} + z_{j,m}\lambda + \gamma_1 EU_{i,j,m} + \gamma_2 \frac{prem_{j,m}}{y_i} + \omega_{i,j,m}$$

- ξ_{jm} is unobserved plan quality (BLP type error)
- z_{jm} includes premium size of network, plan age, and clinical quality variables, consumer reported availability and speed scores.
- Two outside goods: Idemnity (nonmanaged care: High), and Uninsured (Low)
- Excluded IV: average hourly hospital wage, average weekly nurse wage across markets where plan is active. [Why?]

Plan Demand Results

Table 6—Results of Plan Demand Estimation

	Coefficient estimate
Premium ($00 pmpm)	−0.94
	(1.13)
Expected utility from hospital network ($EUrep_{jm}$ or EU_{ijm})	0.59**
	(0.21)
Premium ($00 pmpm) / Income ($000 per year)	0.002
	(43.9)
Physicians per 1,000 population	0.21**
	(0.09)
Breast cancer screening	−0.38
	(2.66)
Cervical cancer screening	4.40**
	(2.09)
Check-ups after delivery	0.18
	(1.38)
Eye exams for diabetics	−1.19
	(1.60)
Adolescent immunization 1	−4.11**
	(1.17)
Adolescent immunization 2	3.08
	(3.76)
Advice on smoking	6.17**
	(2.08)
Mental illness check-ups	2.70**
	(1.30)
Care quickly	0.78
	(5.63)
Care needed	0.85
	(3.99)
Plan age: 0–2 years	1.36
	(0.97)
Plan age: 3–5 years	−0.64
	(1.97)
Plan age: 6–9 years	−0.25
	(0.58)
POS plan	−1.11**
	(0.13)
Constant	−10.50*
	(5.65)
Large plan fixed effects	Yes
Market fixed effects	Yes

Notes: $N = 559$ plans (the 516 HMO/POS plans in the full dataset plus one indemnity/PPO option in each market). Standard errors (adjusted for the three-stage estimation process) are reported in parentheses.

Producer Surplus for Network

Surplus generated by plan j in market m with network H_j is:

$$S_{j,m}\left(H_j, H_{-j}\right) = \sum_i \left(n_i s_{i,j,m}\left(H_j, H_{-j}\right) \left[prem_{j,m} - p_i \sum_{h \in Hj} s_{i,h}\left(H_j\right) cost_h \right] \right)$$

- n_i population per (ZCTA, age, gender) bin
- p_i admission probability of type i individual
- Plan j offers network H_j and rivals networks given by H_{-j}
- Prices and share (and costs) endogenously adjust. (Random re-allocation of patients at capacity constrained hospitals).

Supply Intuition

Why do not all hospitals reach agreement with all plans?

- Dropping plan j from network changes both hospital demand and plan demand.
- Star Hospitals benefit from selecting contracting (consumers have high WTP)
- Hospital may be capacity constrained without contracting with all insurers (capacity may be endogenous)
- A large single system may be very attractive to consumers and induce consumers to switch (e.g. Harvard Pilgrim problem).

Producer Surplus for Network

Profit is surplus generated S_{jm} for network H_j less cost:

$$\pi_{j,m}^{P}\left(H_j, \mathcal{H}_{-j}, \mathcal{X}, \theta\right) = S_{j,m}\left(H_j, \mathcal{H}_{-j}\right) - c_{j,m}^{HOSP}\left(H_j, \mathcal{H}_{-j}, \mathcal{X}, \theta\right) - c_{j,m}^{NONHOSP}\left(H_j, \mathcal{H}_{-j}, \mathcal{X}\right.$$

$$\pi_{j,m}^{P,o}\left(H_j, \mathcal{H}_{-j}, \mathcal{X}^{o}, \theta\right) = \pi_{j,m}^{P}\left(H_j, \mathcal{H}_{-j}, \mathcal{X}, \boldsymbol{\theta}\right) + u_{j,H}$$

- First (eq) econometrician; second (eq) plan beliefs
- Script variables are unobserved when plan makes contracting choice
- Adds econometric error u_{j,H_j} (measurement error) (Cost data is average not per patient)

Predicted profits from choosing H_j can be written

$$E\left(\pi_{j,m}^{P}\left(H_j, \mathcal{H}_{-j}, \mathcal{X}, \theta\right) | I_{j,m}\right) = \pi_{j,m}^{P}\left(H_j, \mathcal{H}_{-j}, \mathcal{X}, \theta\right) - \varphi_{j,H_j}$$

Methodological Innovation

- Plan j's expected profits from network H_j must exceed its expected profits from alternative network where it drops/adds hospital h holding all else fixed
- This represents necessary but not sufficient conditions for equilibrium.

$$E\left(\pi_{j,m}^{P}\left(H_j,\mathcal{H}_{-j},\mathcal{X},\boldsymbol{\theta}\right)|I_{jm}\right) \geq E\left(\pi_{j,m}^{P}\left(H_j^h,\mathcal{H}_{-j},\mathcal{X},\boldsymbol{\theta}\right)|I_{j,m}\right)$$

Combine with both error terms:

$$\pi_{j,m}^{P,o}\left(H_j,\mathcal{H}_{-j},\mathcal{X}^o,\theta\right) - \pi_{j,m}^{P,o}\left(H_j^h,\mathcal{H}_{-j},\mathcal{X}^o,\theta\right) \\ - \left(u_{j,H_j} - u_{j,H_j^h}\right) - \left(\varphi_{j,H_j} - \varphi_{j,H_j^h}\right) \geq 0$$

Second term has expectation zero.

Methodological Innovation

- Resulting estimator combines moment equalities $E[\xi'_{jt} z_{jt}] = 0$ with moment inequalities

$$\frac{1}{M}\sum_{m}\frac{\sqrt{n_m}}{n_m}\sum_{j=1}^{n_m}\left[\left(\pi_{j,m}^{P,o}\left(H_j,\mathcal{H}_{-j},\mathcal{X}^o,\boldsymbol{\theta}\right)-\left(\pi_{j,m}^{P,o}\left(H_j^h,\mathcal{H}_{-j},\mathcal{X}^o,\boldsymbol{\theta}\right)\right)\otimes g\left(z_{j,m}\right)\right]\geq 0$$

- Penalize violations of moment equalities in both directions
- Penalize violations of moment inequalities in only one direction.
- Parameters may be set rather than point identified
- Prof. Dickstein will talk more about estimation/inference.

Full Results

TABLE 7—RESULTS OF FULL MODEL FOR ESTIMATION

Hospital characteristics	Star hospitals	Predicted cap con	Add number of enrollees	Multinomial logit
Number of enrollees			0.011	
Simulated 95 percent C.I.			(−0.06, 0.09)	
Conservative 95 percent C.I.			(−0.17, 0.11)	
Fixed component (unit = $ million per month)				
Hospital in system	0.18	0.16	0.17	−0.60
Simulated 95 percent C.I.	(0.05, 0.37)	(0.03, 0.34)	(0.02, 0.34)	(0.09)
Conservative 95 percent C.I.	(0.18, 0.91)	(0.15, 0.75)	(0.15, 0.66)	
Drop same system hosp	0.09	0.08	0.08	0.62
Simulated 95 percent C.I.	(0.01, 0.16)	(0.01, 0.14)	(0.00, 0.15)	(0.06)
Conservative 95 percent C.I.	(0.04, 0.35)	(0.04, 0.28)	(0.06, 0.29)	
Per patient component (unit = $ thousand per patient)				
Constant	5.51	14.90	6.08	−1.41
Simulated 95 percent C.I.	(−1.93, 16.6)	(1.03, 19.3)	(−2.70, 13.2)	(3.29)
Conservative 95 percent C.I.	(−24.0, 21.5)	(−22.7, 27.9)	(−12.8, 31.4)	
Star hospital	6.77		4.69	7.73
Simulated 95 percent C.I.	(3.27, 15.8)		(0.78, 16.4)	(1.41)
Conservative 95 percent C.I.	(6.40, 27.0)		(4.68, 33.3)	
Cost per admission	−0.80	−1.47	−0.74	−0.39
Simulated 95 percent C.I.	(−1.96, −0.32)	(−2.02, −0.41)	(−1.77, −0.31)	(0.19)
Conservative 95 percent C.I.	(−3.40, 0.16)	(−3.55, −0.32)	(−3.09, 0.04)	
Capacity constrained		6.92		
Simulated 95 percent C.I.		(3.64, 15.7)		
Conservative 95 percent C.I.		(5.36, 24.4)		

Notes: $N = 441$ insurance plans (the 516 in the full dataset less 9 plans in Baltimore, MD; 13 Kaiser plans; 42 with unobserved premiums; and 8 selective plans that I regard as outliers). Figures in parentheses represent 95 percent confidence intervals (C.I.). Plan premium adjustments are incorporated as described in Section IIID. Coefficients represent the predicted profits to the hospital. "Drop same system hosp" is an indicator for hospitals for which a same-system hospital has been excluded. Star hospitals have above ninetieth percentile market share when all plans contract with all hospitals; capacity-constrained hospitals are full under the same thought experiment. "Number of enrollees" is the model's prediction of the plan's number of enrollees given its premium and network choice. The logit results report standard errors calculated using the usual maximum likelihood estimation methodology.

Full Results

TABLE 8—ADDING PLAN AND MARKET CHARACTERISTICS

Hospital characteristics	Beds per population	Number of patients	Local plan	Plan: good screening
Per patient component (unit = $ thousand per patient)				
Constant	8.48	6.26	5.60	7.33
Simulated 95 percent C.I.	(−3.95, 31.9)	(−3.64, 15.9)	(−2.43, 15.5)	(−1.18, 13.6)
Conservative 95 percent C.I.	(−8.05, 58.4)	(−6.86, 20.9)	(−5.78, 21.5)	(−8.16, 21.8)
Star hospital	8.48	6.93	6.36	8.56
Simulated 95 percent C.I.	(1.97, 16.1)	(2.40, 14.9)	(2.12, 12.6)	(2.69, 11.7)
Conservative 95 percent C.I.	(7.36, 35.2)	(5.69, 19.7)	(5.59, 18.9)	(7.67, 23.1)
Cost per admission	−0.76	−0.76	−0.74	−0.93
Simulated 95 percent C.I.	(−2.56, −0.02)	(−1.69, 0.02)	(−1.85, −0.23)	(−1.65, −0.24)
Conservative 95 percent C.I.	(−4.36, 0.52)	(−2.70, −0.16)	(−2.96, −0.24)	(−3.0, −0.27)
Market beds per population	−1.19			
Simulated 95 percent C.I.	(−5.14, 1.70)			
Conservative 95 percent C.I.	(−15.3, −1.17)			
Number of patients		−0.54		
Simulated 95 percent C.I.		(−4.66, 11.0)		
Conservative 95 percent C.I.		(−3.31, 16.2)		
Local plan			1.21	
Simulated 95 percent C.I.			(−0.37, 11.4)	
Conservative 95 percent C.I.			(−7.06, 15.2)	
Breast cancer screen				135.7
Simulated 95 percent C.I.				(−79.9, 251)
Conservative 95 percent C.I.				(−104, 439)

Notes: Results from including plan and market characteristics in per patient profits. $N = 441$ insurance plans. "Beds per population" is the number of hospital beds in the market per 1,000 population. "Number of patients" is the number of the plan's enrollees admitted to the hospital. "Local plan" is an indicator for all plans other than the ten large national chains in the data. "Breast cancer screen" is the difference between the plan's breast cancer screening rate and the average in the market.

Full Results

TABLE 9—ALTERNATIVE SPECIFICATIONS

Hospital characteristics	No prem adjustments	Allow plans to adjust	Allow hosps to adjust	NFP plan obj. finance	Public hosp obj. finance
Fixed component (unit = \$ million per month)					
Hospital in system	0.20	0.07	0.17	0.17	0.12
Simulated 95 percent C.I.	(0.05, 0.41)	(0.02, 0.32)	(0.04, 0.35)	(0.04, 0.33)	(0.04, 0.30)
Conservative 95 percent C.I.	(0.20, 1.03)	(0.07, 0.62)	(0.17, 0.75)	(0.14, 0.82)	(0.12, 0.64)
Drop same system hospital	0.09	0.04	0.08	0.08	0.07
Simulated 95 percent C.I.	(0.01, 0.18)	(0.01, 0.15)	(0.01, 0.15)	(0.01, 0.15)	(0.02, 0.13)
Conservative 95 percent C.I.	(0.04, 0.41)	(0.01, 0.26)	(0.05, 0.32)	(0.02, 0.31)	(0.04, 0.27)
Per patient component (unit = \$ thousand per patient)					
Constant	9.65	9.26	8.15	5.58	9.23
Simulated 95 percent C.I.	(−1.73, 16.7)	(−0.69, 14.5)	(1.41, 18.0)	(−4.17, 17.1)	(−3.62, 16.4)
Conservative 95 percent C.I.	(−20.6, 15.3)	(−14.2, 17.0)	(−14.3, 19.1)	(−22.0, 22.7)	(−21.4, 23.0)
Star hospital	2.76	2.21	2.28	6.64	4.14
Simulated 95 percent C.I.	(1.37, 13.1)	(1.17, 10.4)	(1.39, 13.3)	(0.95, 12.7)	(2.83, 11.8)
Conservative 95 percent C.I.	(2.68, 23.1)	(2.19, 15.6)	(2.19, 20.6)	(6.34, 24.3)	(4.04, 20.7)
Cost per admission	−0.99	−0.90	−0.85	−0.84	−0.85
Simulated 95 percent C.I.	(−1.94, −0.42)	(−1.65, −0.26)	(−1.87, −0.48)	(−1.7, −0.23)	(−1.56, −0.17)
Conservative 95 percent C.I.	(−2.74, −0.07)	(−2.28, 0.04)	(−2.5, −0.18)	(−3.1, −0.05)	(−2.59, 0.07)
NFP plan × enrollees				0.31	
Simulated 95 percent C.I.				(−2.24, 3.15)	
Conservative 95 percent C.I.				(−3.23, 6.13)	
Public hospital × patients					12.38
Simulated 95 percent C.I.					(−19.4, 542)
Conservative 95 percent C.I.					(−30.7, 523)

Notes: Results with alternative specifications. $N = 441$ insurance plans. Figures in parentheses represent 95 percent confidence intervals (C.I.). Column 1 gives the results when plans do not adjust premiums in response to network changes. Columns 2 and 3 allow plans and hospitals, respectively, to respond by changing networks after a deviation by their negotiating partners. Plans are not permitted to adjust premiums in these scenarios, so the results should be compared to column 1. See Sections VA and VD for details. Columns 4 and 5 allow not-for-profit plans and public hospitals to maximize a weighted sum of profits and the number of enrollees/number of patients treated, respectively.

Full Results

TABLE 10—ROBUSTNESS TO CHOICE OF HOSPITAL CHARACTERISTICS

Hospital characteristics	Main specification	Star and cap con	Imaging services	Cap con last year
Fixed component (unit = \$ million per month)				
Hospital in system	0.18	0.12	0.33	0.39
Simulated 95 percent C.I.	(0.05, 0.37)	(0.04, 0.35)	(0.04, 0.54)	(0.06, 0.62)
Conservative 95 percent C.I.	(0.18, 0.91)	(0.12, 0.64)	(0.28, 1.13)	(0.31, 1.4)
Drop same system hospital	0.09	0.06	0.15	0.17
Simulated 95 percent C.I.	(0.01, 0.16)	(0.01, 0.15)	(0.03, 0.24)	(0.03, 0.25)
Conservative 95 percent C.I.	(0.04, 0.35)	(0.02, 0.24)	(0.10, 0.48)	(0.12, 0.57)
Per patient component (unit = \$ thousand per patient)				
Constant	5.51	9.09	3.14	1.37
Simulated 95 percent C.I.	(−1.93, 16.6)	(−5.36, 15.8)	(−9.77, 17.0)	(−13.6, 17.1)
Conservative 95 percent C.I.	(−24.0, 21.5)	(−17.4, 17.2)	(−25.6, 19.3)	(−53.4, 18.8)
Star hospital	6.77	3.48		
Simulated 95 percent C.I.	(3.27, 15.8)	(−0.72, 14.0)		
Conservative 95 percent C.I.	(6.40, 27.0)	(0.35, 27.0)		
Cost per admission	−0.80	−1.10	−0.38	−0.35
Simulated 95 percent C.I.	(−1.96, −0.32)	(−1.89, −0.28)	(−1.56, 0.27)	(−1.63, 0.70)
Conservative 95 percent C.I.	(−3.40, 0.16)	(−2.76, −0.16)	(−2.23, 0.97)	(−2.41, 2.10)
Capacity constrained		4.23		
Simulated 95 percent C.I.		(−6.21, 12.6)		
Conservative 95 percent C.I.		(−12.9, 16.7)		
Imaging services			2.85	
Simulated 95 percent C.I.			(−2.51, 7.90)	
Conservative 95 percent C.I.			(−4.30, 14.4)	
Last year cap con				1.72
Simulated 95 percent C.I.				(−3.20, 8.07)
Conservative 95 percent C.I.				(−7.09, 21.4)

Notes: Results of robustness tests. $N = 441$ insurance plans. The first test includes both star and capacity-constrained hospitals. The second replaces the star variable with an indicator for the 22 percent of hospitals that offer positron emission tomography. The third replaces predicted capacity constraints with an indicator for capacity constraints in the previous year.

Recap

- Hospitals bear about 80% of their own costs. Why?
- Providers have incentive to merge.
- Becoming capacity constrained looks attractive.
- Choice/access is valuable to consumers even for seldom chosen “star” hospitals that are far away.