Physician Behaviors and Hospital Influence

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October 18, 2018

Background

How are hospitals and physicians related?

1. "Traditional" private practice with admitting privileges
2. Administrative support with or without admitting restrictions
3. Practice owned by hospital or hospital system

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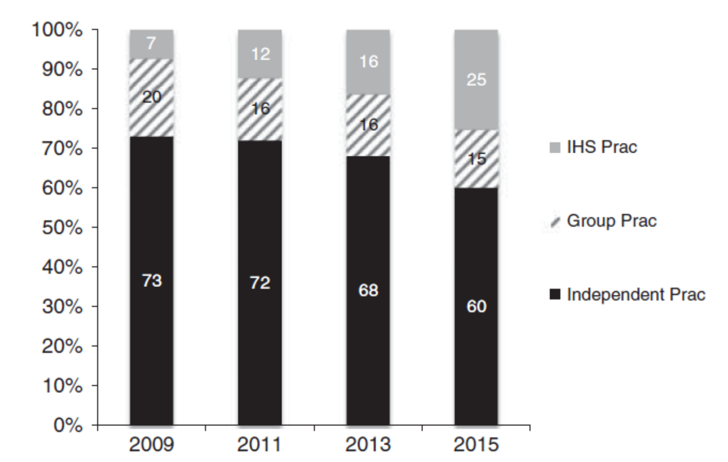

Richards *et al.*, Medical Care, 2016

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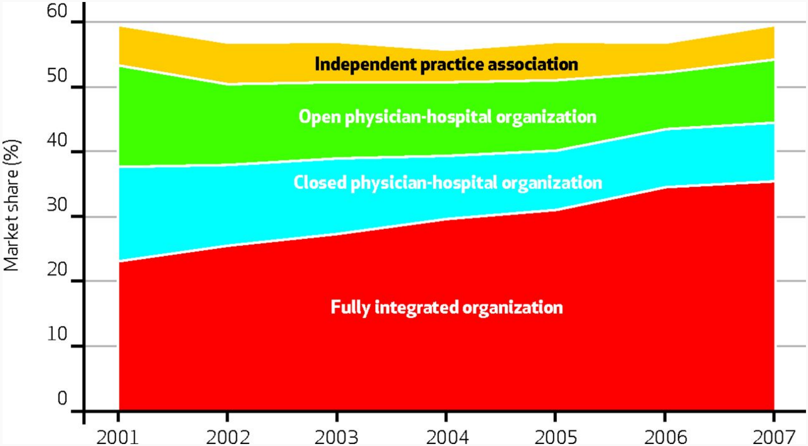

Baker, Bundorf, and Kessler, Health Affairs, 2014

Why would a hospital integrate?

Direct Revenue

- Increase bargaining position
- Exploit payment differentials

Why would a hospital integrate?

Indirect Revenue

- Hospital Readmission Reduction Program
- Hospital Value Based Purchasing Program
- Accountable Care Organizations and Bundled Payments
- Product Bundling

Why would a hospital integrate?

Cost reduction

- Remove inefficiencies from fragmented care
- Improve quality via "team-based" care
- Faster time to discharge
- Streamline devices

Why would a physician practice integrate?

Financial security

- Salaried arrangement
- Potential volume incentives

Why would a physician practice integrate?

Reduce administrative burden

- Billing and insurance approvals
- Electronic Health Records
- Data collection/reporting

Takeaway

1. Incentives for the hospitals to influence physician behaviors
2. Willingness by physicians to allow influence

Theoretical Framework

Measuring Physician Agency

Observed care at time t is

$$y_{ijk} = \arg\max_{y} \theta_u \tilde{u}\left(y; \Gamma_j, \kappa_i\right) + \theta_\pi \pi\left(y; \Gamma_k, \Gamma_j\right),$$

where $\tilde{u}$ is additively separable in i and (j, k) and where maximizing levels of y for $\tilde{u}$ and π are linear in y

Measuring Physician Agency

$$y_{ijk} = \alpha_i + x_i\beta + \Gamma_{jk} + \epsilon_{ijk},$$

- α_i, unobserved patient characteristics
- x_i, observed patient characteristics
- Γ_{jk}, a function of observed and unobserved physician and hospital characteristics

Variation in Physician Agency

What characteristics of the hospital, physician, and physician practice tend to drive variation in care, conditional on patient preferences?

$$\Gamma_{jkt} = \gamma_j + \gamma_k + \tau_t + z_{jkt}\delta + \eta_{jkt},$$

- γ_j, unobserved and time-invariant physician characteristics
- γ_k, unobserved and time-invariant hospital characteristics
- τ_t, unobserved year factors affecting all physicians and hospitals
- z_{jkt}, observed and time-varying physician and hospital characteristics

Data

Data Sources

- CMS: 100% inpatient Medicare claims data (2008-2015)

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- SK&A: Hospital ownership of physician practices
- AHA, HCRIS, POS: Hospital characteristics
- ACS: County-level demographics, education, income, and employment

Sample Construction

- Planned inpatient operations with observed NPI for the operating physician, defined as elective admissions initiated by a physician, clinic, or HMO referral

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- Drop lowest/highest 1% of inpatient charges and patients $<$ 65 years old

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- Drop lowest/highest 1% of inpatient charges and patients $<$ 65 years old

$\Longrightarrow$ 518,398 unique observations at the physician/hospital/year

$\Longrightarrow$ 7.5mm inpatient stays (47% of total)

Estimation of Match Values

Specification

$$y_{ijk} = \alpha_i + x_i\beta + \Gamma_{jk} + \epsilon_{ijk},$$

Outcomes

$$y_{ijk} = \alpha_i + x_i\beta + \Gamma_{jk} + \epsilon_{ijk},$$

- Inpatient charges
- Length of stay
- 30/60/90-day mortality

Independent Variables

$$y_{ijk} = \alpha_i + x_i\beta + \Gamma_{jk} + \epsilon_{ijk},$$

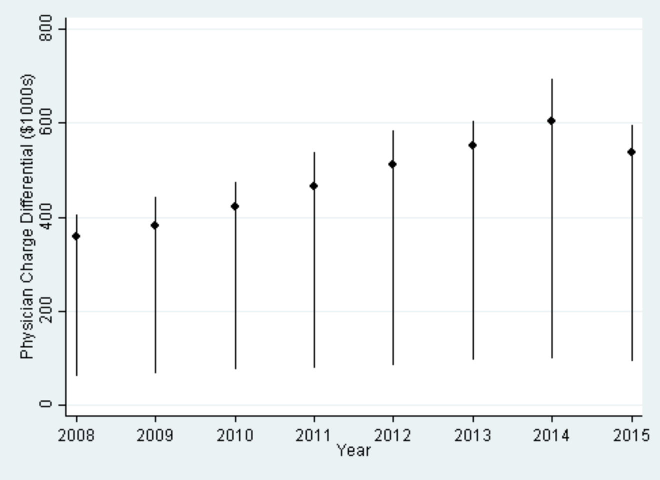
- Quartiles of total Medicare payments and inpatient claims
- Covers 2008 through 2015 period
- Beneficiary-specific measure of “utilization”

Independent Variables

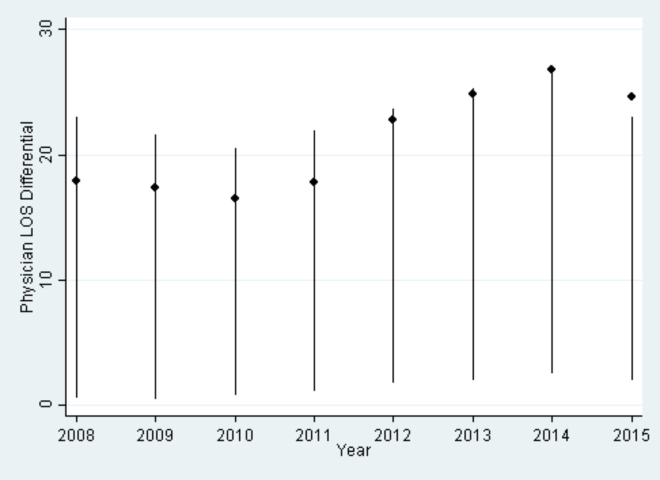
$$y_{ijk} = \alpha_i + x_i\beta + \Gamma_{jk} + \epsilon_{ijk},$$

- Age
- Gender
- Race
- Dummies for first 5 ICD diagnosis codes (18 diagnosis groups per variable plus missing group)

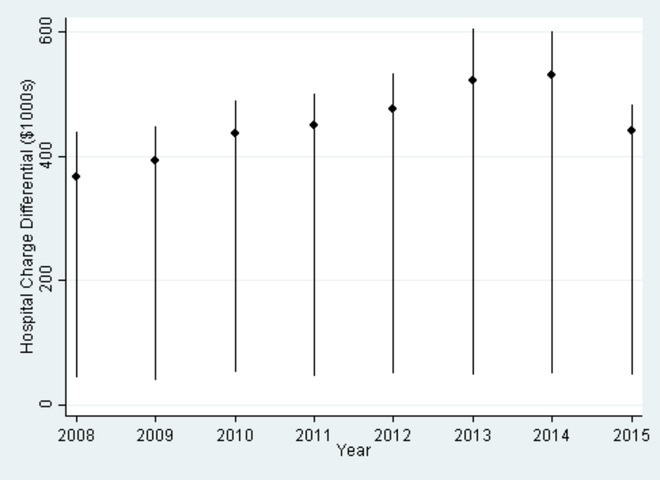
Within-physician Variation in Charges



Within-physician Variation in LOS



Within-hospital Variation in Charges



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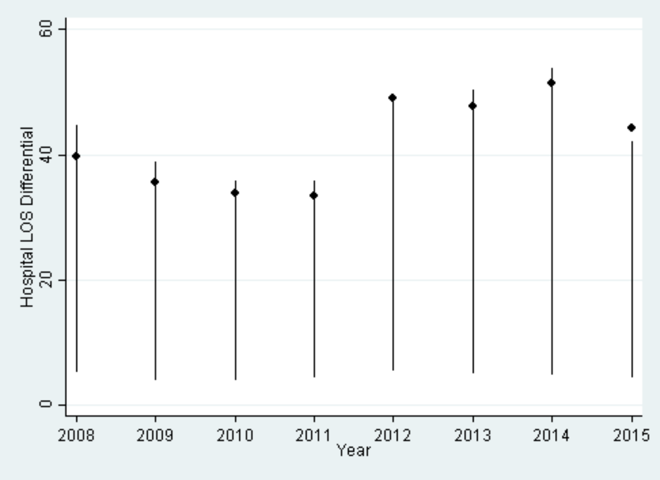

Estimation of Institutional Influence

Specification

$$\hat{\Gamma}_{jkt} = \gamma_j + \gamma_k + \tau_t + z_{jkt}\delta + \eta_{jkt},$$

Outcomes: Hospital Share and Operations

$$\hat{\Gamma}_{jkt} = \gamma_j + \gamma_k + \tau_t + z_{jkt}\delta + \eta_{jkt},$$

	2008	2012	2013	2014	2015	Overall
Hospital Share	0.687	0.713	0.719	0.726	0.753	0.712
	(0.366)	(0.357)	(0.356)	(0.353)	(0.339)	(0.358)

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	(0.366)	(0.357)	(0.356)	(0.353)	(0.339)	(0.358)
Operations	18.55	18.21	18.61	18.82	20.23	18.58
	(26.03)	(26.02)	(26.94)	(27.32)	(28.87)	(26.46)

Outcomes: Charges and Length of Stay

$$\hat{\Gamma}_{jkt} = \gamma_j + \gamma_k + \tau_t + z_{jkt}\delta + \eta_{jkt},$$

	2008	2012	2013	2014	2015	Overall
Hospital Charge	41,829	56,920	61,780	66,497	69,965	54,549
	(27,807)	(37,505)	(40,228)	(43,196)	(46,204)	(37,579)

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Length of Stay	5.984	6.021	6.002	6.062	6.031	5.960
	(2.427)	(2.493)	(2.494)	(2.513)	(2.613)	(2.449)

Outcomes: Mortality

$$\hat{\Gamma}_{jkt} = \gamma_j + \gamma_k + \tau_t + z_{jkt}\delta + \eta_{jkt},$$

	2008	2012	2013	2014	2015	Overall
90-day Mortality	0.0628	0.0604	0.0586	0.0575	0.0569	0.0600
	(0.147)	(0.144)	(0.143)	(0.140)	(0.145)	(0.145)

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60-day Mortality	0.0521	0.0497	0.0485	0.0475	0.0461	0.0495
	(0.133)	(0.130)	(0.130)	(0.127)	(0.131)	(0.131)

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	(0.133)	(0.130)	(0.130)	(0.127)	(0.131)	(0.131)
30-day Mortality	0.0375	0.0354	0.0349	0.0340	0.0318	0.0353
	(0.113)	(0.109)	(0.110)	(0.107)	(0.108)	(0.110)

Independent Variables

$$\hat{\Gamma}_{jkt} = \gamma_j + \gamma_k + \tau_t + z_{jkt}\delta + \eta_{jkt},$$

	2008	2012	2013	2014	2015	Overall
Integrated	0.130	0.206	0.233	0.255	0.332	0.196
	(0.336)	(0.404)	(0.422)	(0.436)	(0.471)	(0.397)

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Physician FTE	24.23	28.59	31.14	31.74	33.13	28.43
	(99.28)	(109.8)	(120.5)	(120.0)	(119.5)	(110.9)

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Resident FTE	25.77	28.45	29.13	30.69	30.97	28.08
	(108.2)	(120.4)	(121.4)	(125.9)	(127.8)	(117.8)

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Nurse FTE	340.8	365.7	369.1	384.9	402.7	364.8
	(446.8)	(487.8)	(494.8)	(519.1)	(550.7)	(487.3)

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Other FTE	749.9	763.0	761.8	776.4	806.0	762.8
	(975.5)	(1032.4)	(1076.2)	(1101.5)	(1157.2)	(1037.4)

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	(975.5)	(1032.4)	(1076.2)	(1101.5)	(1157.2)	(1037.4)
Beds (100s)	1.980	1.967	1.958	1.982	2.009	1.976
	(2.160)	(2.142)	(2.137)	(2.172)	(2.235)	(2.154)

Independent Variables

$$\hat{\Gamma}_{jkt} = \gamma_j + \gamma_k + \tau_t + z_{jkt}\delta + \eta_{jkt},$$

	2008	2012	2013	2014	2015	Overall
Practice Size	13.73	17.31	17.31	17.82	18.41	16.10
	(32.10)	(30.70)	(29.28)	(28.46)	(28.02)	(30.05)

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Practice Size	13.73	17.31	17.31	17.82	18.41	16.10
	(32.10)	(30.70)	(29.28)	(28.46)	(28.02)	(30.05)
Experience	22.55	23.00	23.94	23.65	24.77	23.17
	(6.496)	(6.703)	(6.950)	(6.902)	(6.989)	(6.746)

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Experience	22.55	23.00	23.94	23.65	24.77	23.17
	(6.496)	(6.703)	(6.950)	(6.902)	(6.989)	(6.746)
% Multi-Specialty	0.249	0.248	0.266	0.284	0.344	0.264
% with Surgery	0.452	0.501	0.507	0.508	0.454	0.480

Initial Results

	Vert. Int.	Practice Size	Beds
Mean Outcomes			
Share	0.068***	0.000*	0.003***
	(0.003)	(0.000)	(0.001)
Operations	1.166***	0.013***	0.061
	(0.165)	(0.003)	(0.066)
Charge	978.334***	23.713***	154.701
	(215.302)	(4.234)	(95.896)
LOS	-0.001	0.001***	0.020**
	(0.017)	(0.000)	(0.008)

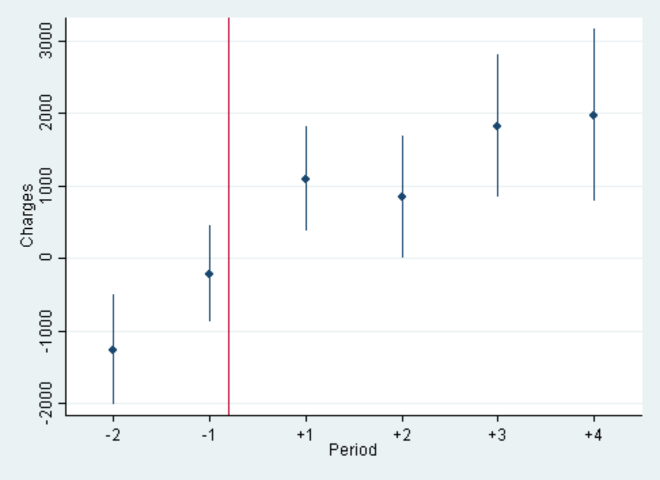
Initial Results

	Vert. Int.	Practice Size	Beds
Γ_{jkt}			
Charge	824.251***	22.890***	163.798*
	(187.598)	(3.669)	(87.130)
LOS	-0.007	0.002***	0.012
	(0.017)	(0.000)	(0.008)

Initial Results

	Vert. Int.	Practice Size	Beds
Γ_{jkt}			
Charge	824.251***	22.890***	163.798*
	(187.598)	(3.669)	(87.130)
LOS	-0.007	0.002***	0.012
	(0.017)	(0.000)	(0.008)
Γ_{jkt} with quality			
Charge	808.072***	22.649***	160.556*
	(187.311)	(3.660)	(86.871)
LOS	-0.008	0.002***	0.012
	(0.017)	(0.000)	(0.008)

Event Study



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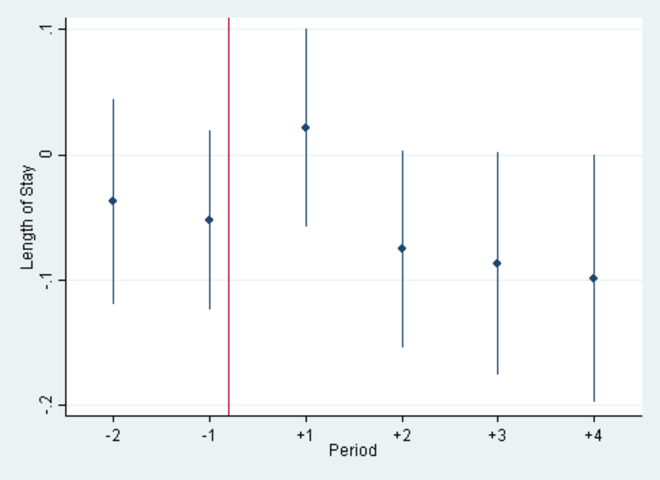

Differential Trends

	Vert. Int.	Practice Size	Beds
Γ_{jkt}			
Charge	258.516	20.670***	192.032**
	(191.137)	(3.676)	(86.632)
LOS	0.005	0.002***	0.012
	(0.018)	(0.000)	(0.008)

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Γ_{jkt}			
Charge	258.516	20.670***	192.032**
	(191.137)	(3.676)	(86.632)
LOS	0.005	0.002***	0.012
	(0.018)	(0.000)	(0.008)
Γ_{jkt} with quality			
Charge	241.378	20.390***	188.895**
	(190.720)	(3.666)	(86.373)
LOS	0.003	0.002***	0.011
	(0.018)	(0.000)	(0.008)

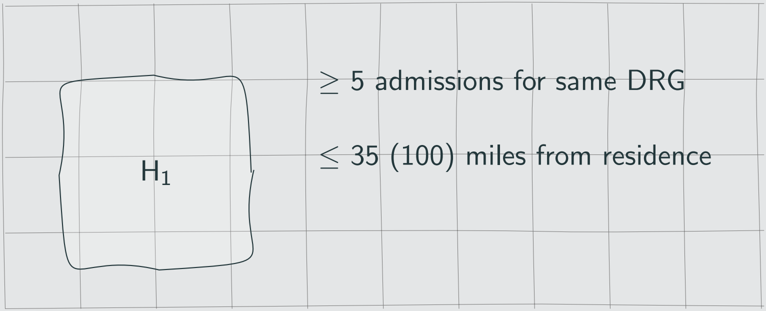
Endogeneity of physician-hospital integration

Integration could be driven by:

- Existing physician behaviors
- Unobserved, time-varying practice characteristics

Endogeneity of physician-hospital integration

1. Set of possible physician-hospital pairs



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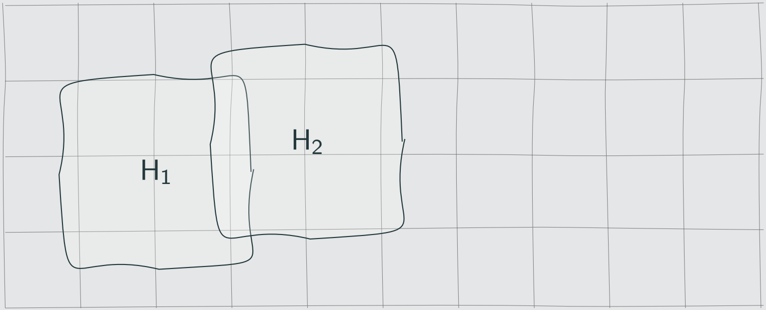

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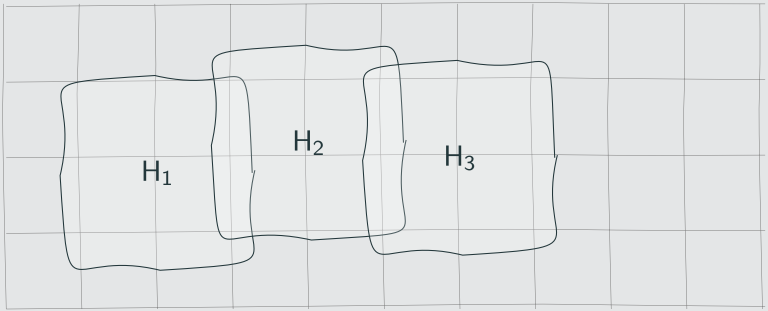

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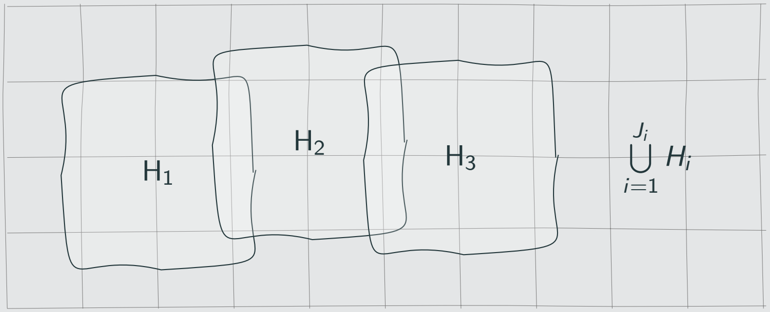

Endogeneity of physician-hospital integration

2. Estimate probability of integration (at practice level)

$$I_{pk} = \lambda z_{pk} + \omega_{pk}$$

- Average choice set size
- Average differential distance (relative to nearest hospital)
- Differential distance interacted with hospital characteristics

Endogeneity of physician-hospital integration

2. Estimate probability of integration

$$I_{pk} = \lambda z_{pk} + \omega_{pk}$$

- Average choice set size
- Average differential distance (relative to nearest hospital)
- Differential distance interacted with hospital characteristics

$$\hat{\Gamma}_{jkt} = \gamma_j + \gamma_k + \tau_t + \underbrace{I_{jkt}}_{\hat{I}_{jkt}=\Pr(I_{jkt}=1)} \delta_1 + \tilde{z}_{jkt}\delta_2 + \eta_{jkt},$$

Summary of Preliminary Results

Effects of Vertical Integration

- Increase in shares of about 7 percentage points (10%)
- No improvement in mortality
- Potential increase in charges but relatively small (no more than 1.5% or $850 per operation)

Summary of Preliminary Results

Effects of Practice Size

10-person increase in practice, \$200-\$250 increase in charge

Summary of Preliminary Results

Effects of Bed Size

Increase of 100 beds, \$150-\$200 increase in charge

Next Steps

- Exclude never-integrating hospitals
- Identify physician "movers"
- Focus on specific DRG (470)
- Examine institutional care beyond the inpatient stay