Physician Behaviors and Hospital Influence

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April 20, 2019

Background

Physician Agency

Physician with decision-making authority for treatment

- Information asymmetry
- Regulatory restrictions

Physician Agency

Differential financial incentives between physician and hospital

- More procedures $=$ more revenue, but location of procedure may matter to hospital
- Hospital wants less cost with fixed payment, but physician dictates resource use
- Hospital as residual claimant on billable physician services

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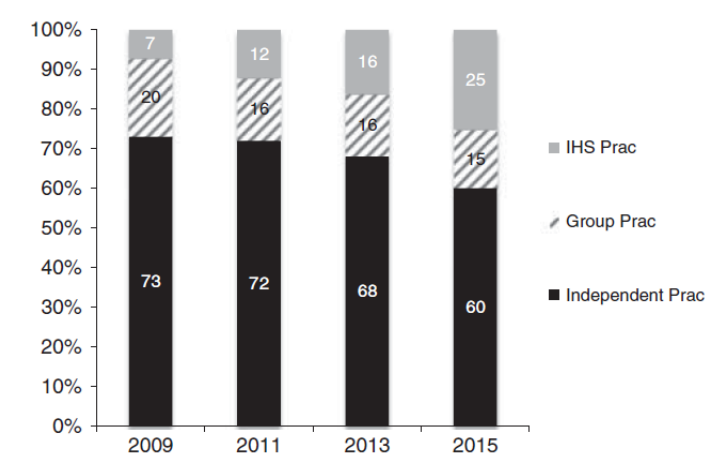
Most direct way (arguably) is to purchase physician practice

Changing Physician Relationships



Richards *et al.*, Medical Care, 2016

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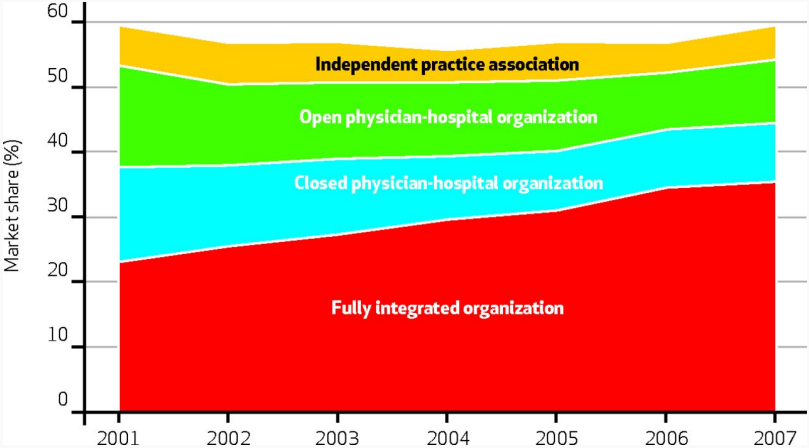

Baker, Bundorf, and Kessler, Health Affairs, 2014

In context

- Physician agency (Clemens & Gottlieb 2014, AER; Afendulis & Kessler 2007, AER; Gruber & Owings 1996, RAND; Iizuka 2012, AER)
- Supply-side variation (Finkelstein *et al.* 2016, QJE; Molitor 2018, AEJ: Policy)
- Vertical integration (Cuellar & Gertler 2006, JHE; Ciliberto & Dranove 2006, JHE; Baker *et al.* 2016, JHE; Koch *et al.* 2017, JHE)

Theoretical Framework

Physician Agency

Observed care at time t is

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

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With assumptions on linearity and separability in patient preferences:

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

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Patient Preferences

Physician and hospital characteristics

Estimation Strategy

Suggests two-step estimation strategy:

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1. Estimate $y_{ijk} = \alpha_i + x_i\beta + \Gamma_{jk} + \epsilon_{ijk}$ at patient level (separately by year). This isolates variation in care to physicians and hospitals (not patients).

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2. Estimate $\hat{\Gamma}_{jkt} = \gamma_j + \gamma_k + \tau_t + z_{jkt}\delta + \eta_{jkt}$ with physician-hospital panel. This further isolates variation to physician-hospital interaction.

Estimation Strategy

- Draws from “match values” in labor literature (Abowd *et al.*, 2002; Card *et al.*, 2013, QJE)
- Exploits variation across inpatient stays and splits the separation of match value into two steps
- Identifies effects on match value from within-physician variation across hospitals (e.g., patient movers in Finkelstein *et al.*, 2016, QJE)

Estimation Strategy

Traditional “match value” approach:

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Physician effect

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Physician effect

Hospital effect

Physician-hospital match value

Estimation Strategy

Our approach:

$$y_{ijk} = \alpha_i + x_i\beta + \underbrace{\Gamma^t_{jk}}_{\Gamma_j + \Gamma_k + z_{jkt}\delta} + \epsilon_{ijk}$$

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Physician, hospital, and match effect (jointly)

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Physician effect

Hospital effect

Physician-hospital integration

Intuition

- Hospital influence on physicians is an interaction effect
- Potential influence should be net of patient preference

Data

Data Sources

- CMS: 100% inpatient and institutional outpatient Medicare claims data (2008-2015)
- SK&A: Hospital ownership of physician practices and practice characteristics
- AHA, HCRIS, POS: Hospital characteristics
- Annual IPPS Impact Files: Hospital cost-to-charge ratios (CCR)
- ACS: County-level demographics, education, income, and employment

Sample Construction

- Planned inpatient stays (elective admissions initiated by a physician, clinic, or HMO referral) and outpatient procedures with observed NPI for the operating physician

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$\longrightarrow$ 518,398 unique observations at the physician/hospital/year
$\longrightarrow$ 7.5mm inpatient stays (47% of total) and 24mm outpatient procedures

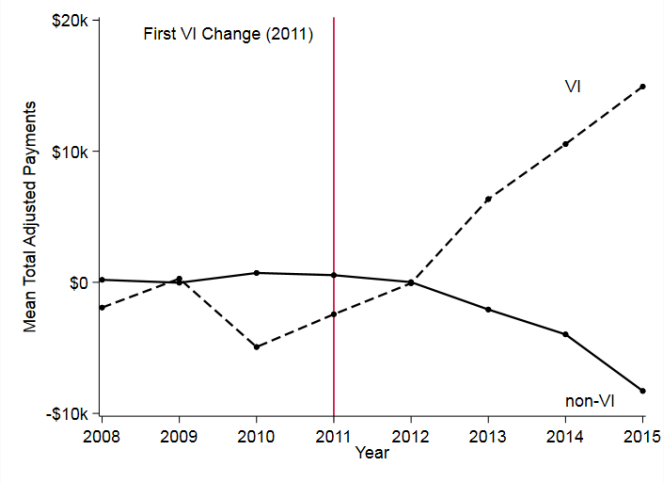
Preliminary Evidence

Total Spending by Integration Status

Estimate and plot residual from:

$$y_{jkt} = \beta x_{jt} + \delta z_{kt} + \lambda_k + \lambda_j + \lambda_t + \varepsilon_{jkt}$$

Total Spending by Integration Status



Total Spending by Integration Status

Components of aggregate effect:

1. Total number of patients for physician k
2. Change in patient profile
3. Reallocation of patients across hospitals
4. Change in treatment for observationally equivalent patients

Estimation of Match Values

Specification

Two-step estimation strategy:

1. Estimate $y_{ijk} = \alpha_i + x_i\beta + \Gamma_{jk} + \epsilon_{ijk}$ at patient level (separately by year)
2. Estimate $\hat{\Gamma}_{jkt} = \gamma_j + \gamma_k + \tau_t + z_{jkt}\delta + \eta_{jkt}$ with physician-hospital panel

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Outcomes

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

- Total inpatient and outpatient Medicare payments
- Total inpatient and outpatient hospital costs (from cost-to-charge ratios)

Independent Variables

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

- Quartiles of total “other” Medicare payments and procedures
- Covers 2008 through 2015 period
- Beneficiary-specific ranking of health care utilization

Independent Variables

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

- Age, gender, race
- Indicators for ICD9 diagnosis code groups (18 diagnosis groups per variable plus missing group)
- Indicators for primary DRGs (with at least 1000 observations in a given year)

Estimation of Hospital Influence

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	2008	2012	2013	2014	2015	Overall
Total Payments	7,152	8,171	8,501	8,941	9,169	8,094
	(7,595)	(8,472)	(8,290)	(8,724)	(8,755)	(8,228)

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Total Costs	9,387	11,323	11,756	12,237	12,736	10,965
	(9,632)	(10,954)	(10,906)	(11,549)	(11,728)	(10,626)

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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	(99.28)	(109.8)	(120.5)	(120.0)	(119.5)	(110.9)

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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

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	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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	(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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	(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
% Surgery Center	0.452	0.501	0.507	0.508	0.454	0.480

Estimated Effects of Vertical Integration

Outcome	Estimate	St. Error

* p-value <0.1, ** p-value <0.05, *** p-value <0.01

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Outcome	Estimate	St. Error
Total Medicare Payments	75.121**	(30.902)

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Estimated Effects of Vertical Integration

Outcome	Estimate	St. Error
Total Medicare Payments	75.121**	(30.902)
Total Hospital Costs	132.466***	(42.026)

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Estimated Effects of Vertical Integration

Outcome	Estimate	St. Error
Total Medicare Payments	75.121**	(30.902)
Total Hospital Costs	132.466***	(42.026)
Total Stays	0.015***	(0.004)

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Threats to Identification and Interpretation

Estimator is effectively a two-way fixed effects DD with time varying treatment

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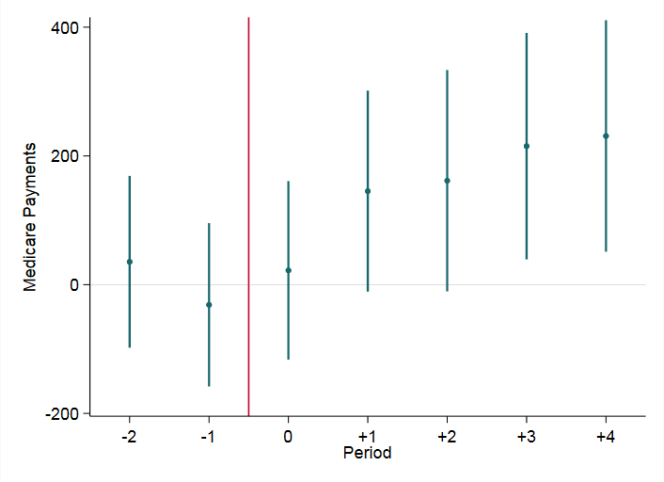
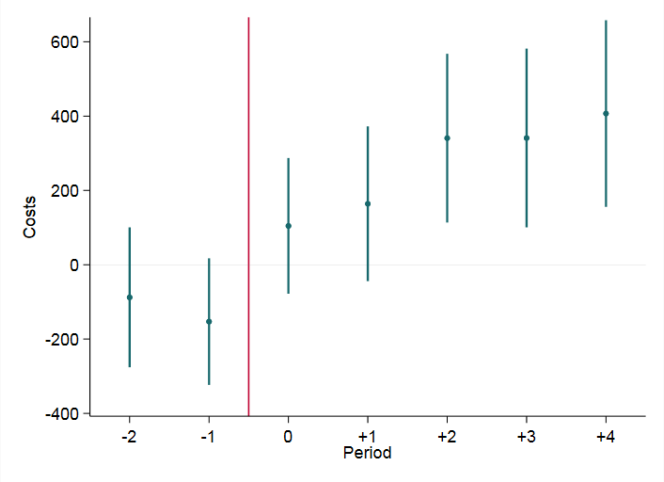
Potential Problems

1. Vertical integration due to time-varying unobservables & outcomes (standard DD concern)
2. Weighted average of all 2×2 DD estimates, with some potentially negative weights

Event Study: Total Medicare Payments



Event Study: Total Hospital (IP & OP) Costs



Takeaways

- Increase in payments and costs
- Evidence consistent with common trends assumption for total payments and costs
- Concerns about limited pre-period data

Endogeneity of physician-hospital integration

Integration could be driven by:

- Unobserved, time-varying practice characteristics
- Existing costs and treatment patterns

Endogeneity of physician-hospital integration

1. Set of possible physician-hospital pairs

Form set of all hospitals where physician operates from 2008-2015

Endogeneity of physician-hospital integration

2. Estimate probability of integration

$$\Pr\left(I_{jk}=1\right)=\frac{\exp\left(\lambda z_{jk}\right)}{1+\exp\left(\lambda z_{jk}\right)}$$

- Hospital and practice characteristics
- Average differential distance (relative to nearest hospital in patient choice set)
- Differential distance interacted with hospital and practice characteristics

Endogeneity of physician-hospital integration

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Intuition: Physicians less likely to seek/allow acquisition if patients live further away

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IV Results: Aggregate Outcomes

Outcome	Estimate	St. Error

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Outcome	Estimate	St. Error
Total Medicare Payments	870.384**	(340.409)

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IV Results: Aggregate Outcomes

Outcome	Estimate	St. Error
Total Medicare Payments	870.384**	(340.409)
Total Hospital Costs	2,545.815***	(454.697)

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IV Results: Aggregate Outcomes

Outcome	Estimate	St. Error
Total Medicare Payments	870.384**	(340.409)
Total Hospital Costs	2,545.815***	(454.697)
Total Stays	0.271***	(0.042)

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Does this Reflect Hospital Influence?

Reallocation of Patients

Outcome	Estimate	St. Error
Total Medicare Payments	75.121**	(30.902)
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Reallocation of Patients

Outcome	Estimate	St. Error
Total Medicare Payments	75.121**	(30.902)
Total Hospital Costs	132.466***	(42.026)
Total Stays	0.015***	(0.004)
Total Medicare Payments	63.291**	(30.853)
Total Hospital Costs	124.830***	(42.073)
Total Stays	0.014**	(0.004)

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Areas with most incentives...

If hospital is residual claimant on billable procedures, should see more procedures within inpatient stays

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If hospital is residual claimant on billable procedures, should see more procedures within inpatient stays

Outcome	Estimate	St. Error
Inpatient Costs	165.441***	(50.165)
Procedure Count	0.030***	(0.009)

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Effects on Total Procedures and Patients

Aggregate Effects

Other ways integration posited to affect physician behavior:

- More procedures overall (largely coming from outpatient)
- Reallocating procedures (increased share to hospital)
- Changing patient profile (no evidence)

Summary of Results

Main Findings

- Increase in Medicare payments ($75 to $200) and hospital costs ($130-$350)
- Extrapolates to between $55 and $146 million in added Medicare payments from vertical integration
- Explains 4% to 10% of within-physician variation in Medicare payments

Summary of Results

Sensitivity

- Event study consistent with common pre-trends but limited pre-period data
- IV results suggest conservative estimates
- No improvement in quality (mortality)
- As falsification test, no effects on payments or DRG weights per inpatient stay

Thank You!