What do Nonprofit Hospitals Maximize?

Evidence from California's Seismic Retrofit Mandate

Tom Chang and Mireille Jacobson

Motivation

Hospital market is mostly made up of nonprofit hospitals.

The community benefits hospitals must provide to classify as a nonprofit are ambiguous.

True motives of a nonprofit hospital are unknown.

- Quality of care
- Quantity of patients
- Profit

Research Question

What is a nonprofit hospital’s objective function?

Research Question

What is a nonprofit hospital's objective function?

- Exogenous fixed cost shock

Research Question

What is a nonprofit hospital's objective function?

- Exogenous fixed cost shock
- Analyze changes in hospital operations

Research Question

What is a nonprofit hospital's objective function?

- Exogenous fixed cost shock
- Analyze changes in hospital operations
- Test four possible objective functions

Main Results Preview

Hospital Reactions to Fixed Cost Shock

- Higher seismic risk hospitals more likely to close
- Nonprofits increase spending on property, plant, and equipment
- Private nonprofits increase profitable services

Nonprofit Hospital Objectives

- Reject profit and pure altruism as potential objective functions
- Welfare implications are ambiguous

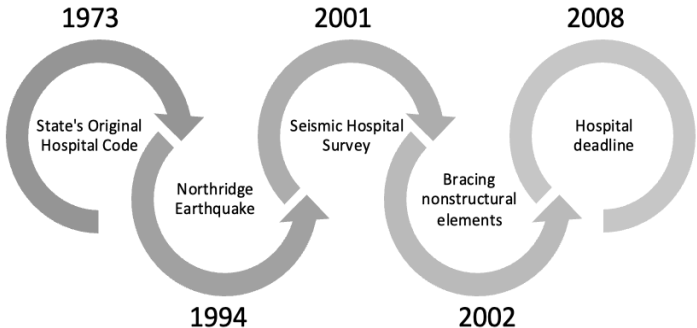
Literature Review

Literature has mixed results about the motives of nonprofit hospitals.

- No difference between nonprofit and for-profit hospitals: Sloan and Vraciu (1983), Becker and Sloan (1985), Gaumer (1986), Schlesinger and Gray (2003)
- Systematic differences: Horwitz (2005), Bayindir (2012), Duggan (2000)

California's Seismic Retrofit Mandate

New seismic safety requirement standards all general acute care hospitals must meet to remain open.



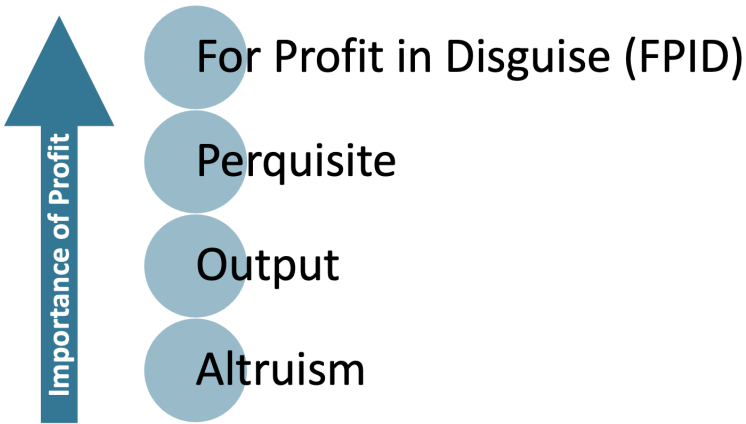
Basic Model

$$V = R + v(q, \theta, u)$$

$$pq - C(q, \theta) - R - u - \mathbf{F} \geq 0$$

- R: net revenue
- q: quantity of health care provided
- θ: non-contractible factors
- u: uncompensated care
- C: cost function
- p: price
- F: fixed cost

Alternative Objective Functions



Predicted Response

$$V = R + v(q, \theta, u)$$

	Profitable Care (q)	Uncompensated Care (u)	Distortionary Perquisites (θ)
FPID	0	0	0
Perquisite	+	0	-
Output	+/-	+/-	+/-
Altruism	-	-	-

Data

Seismic Risk	Hospital Services	Hospital Finances
► California Geological Survey ► Peak ground acceleration (pga) factor	► OSHPD's Annual Utilization Report ► Hospital Ownership ► Hospital characteristics from 1992-2006	► OSHPD's Hospital Annual Financial Database ► Spending on property, plant, and equipment from 1996-2006

Reduced Form Approach

Hospital closures and spending on plant, property, and equipment

$$Y_h = pga_h + \beta X_h + \gamma_c + \epsilon_{h,c}$$

Reduced Form Approach

Hospital closures and spending on plant, property, and equipment

$$Y_h = pga_h + \beta X_h + \gamma_c + \epsilon_{h,c}$$

Reduced Form Approach

Hospital closures and spending on plant, property, and equipment

$$Y_h = \mathbf{pga_h} + \beta X_h + \gamma_c + \epsilon_{h,c}$$

Reduced Form Approach

Hospital closures and spending on plant, property, and equipment

$$Y_h = pga_h + \beta \boldsymbol{X_h} + \gamma_c + \epsilon_{h,c}$$

Reduced Form Approach

Hospital closures and spending on plant, property, and equipment

$$Y_h = pga_h + \beta X_h + \gamma_c + \epsilon_{h,c}$$

Results for Hospital Closures

Hospital Closures: 1996-2006 [a]

	OLS		*Probit*	
pga	0.328	0.328	0.281	0.333
	(0.095)**	(0.114)**	(0.101)**	(0.132)*
pga * Public		0.041		-0.090
		(0.241)		(0.228)
pga * For-Profit		-0.042		- 0.105
		(0.315)		(0.230)
Public	-0.012	-0.032	-0.015	0.028
	(0.058)	(0.158)	(0.056)	(0.152)
For-Profit	0.098	0.119	0.042	0.103
	(0.056)	(0.178)	(0.049)	(0.166)
Adj. R-squared	0.036	0.031	0.174	0.176
Observations	454	454	366	366

[a]Notes:

1. All regressions include county fixed effects as well as the age of the hospital, age of the hospital squared, the number of licensed beds in 1992, 1992 ownership status (government-owned or for-profit, with nonprofit status excluded), rural status, multi-system status, and 1996 teaching status. Teaching status is measured as of 1996 because of data limitations.
2. Standard errors are clustered at the county level. We denote significance at the 10%, 5% and 1% levels as +, * and **, respectively.

Seismic risk increases the probability of closure.

Results for Plant, Property, and Equipment (PPE) Spending

Plant Property and Equipment Spending [a]

	Hospitals Operating 1996-2006				*All Hospitals in Operation in 1996*			
	TOTAL		*Log(TOTAL)*		*TOTAL*		*Log(TOTAL)*	
pga	835	1,495	0.731	1.62	1,018	1,280	2.28	0.478
	(333)*	(330)**	(0.601)	(0.681)*	(294)**	(253)**	(1.13)*	(1.55)
pga * Public		-2,169		-2.32		-552		5.83
		(538)**		(0.673)**		(611)		(1.61)*
pga * For-Profit		-1,405		-2.71		-720		2.63
		(542)**		(1.33)*		(345)*		(2.94)
Public	-778	326	-0.679	0.497	-508	-231	1.10	-1.86
	(189)**	(356)	(0.164)**	(0.360)	(144)**	(299)	(0.525)*	(0784.)*
For-Profit	-559	117	-1.67	-0.354	-239	116	1.70	0.415
	(134)**	(254)	(0.339)**	(0.652)	(96.7)*	(1175)	(0.583)**	(1.10)
Adj. R-squared	0.464	0.476	0.318	0.329	0.451	0.451	0.252	0.256
Observations	319	319	319	319	454	454	454	454

[a]Notes:

1. All regressions include county fixed effects as well as the age of the hospital, age of the hospital squared, the number of licensed beds in 1992, (or the earliest year available, with an indicator to account for such substitution), 1992 ownership status (government-owned or for-profit, with nonprofit status excluded), rural status, multi-system status, and 1996 teaching status. Teaching status is measured as of 1996 because of data limitations.
2. Standard errors are clustered at the county level. We denote significance at the 10%, 5% and 1% levels as +, * and **, respectively.
3. Amounts for all years deflated to 2006 dollars.
4. PPE includes land purchases, building improvements, equipment spending and ongoing construction costs.
5. The first four columns capture hospitals operating continuously between 1996 and 2006. The last four columns set missing PPE values to zero and includes an indicator variable to capture whether such a substitution was made.

Seismic risk is positively related to total PPE spending.

Reduced Form Approach

Changes in hospital operations

$$\Delta Y_{hct,t-n} = pga_h + \beta X_{hct} + \gamma_c + \epsilon_{hct}$$

Reduced Form Approach

Changes in hospital operations

$$\Delta Y_{hct,t-n} = pga_h + \beta X_{hct} + \gamma_c + \epsilon_{hct}$$

Reduced Form Approach

Changes in hospital operations

$$\Delta Y_{hct,t-n} = \boldsymbol{pga_h} + \beta X_{hct} + \gamma_c + \epsilon_{hct}$$

Reduced Form Approach

Changes in hospital operations

$$\Delta Y_{hct,t-n} = pga_h + \beta \boldsymbol{X_{hct}} + \gamma_c + \epsilon_{hct}$$

Reduced Form Approach

Changes in hospital operations

$$\Delta Y_{hct,t-n} = pga_h + \beta X_{hct} + \gamma_c + \epsilon_{hct}$$

Results for Service Provision

Changes in Total Beds, Days and Discharges: 1992-2006 [a]

	Beds	*Days*	*Discharges*	*% Beds Staffed*	*Days/Bed*	*Days/Discharge*
pga	79.7	8.93	1.88	0.128	-35.	-17.3
	(36.1)*	(18.6)	(2.37)	(0.076)	(81.0)	(14.5)
pga * Public	103	18.2	0.745	0.140	11.5	7.90
	(64.5)	(19.8)	(2.61)	(0.085)	(65.8)	(11.0)
pga * For-Profit	-1.54	-7.56	-0.208	-0.125	-86.6	15.4
	(60.5)	(12.9)	(1.74)	(0.138)	(98.1)	(11.7)
Public	-40.5	-18.3	-2.38	-0.049	-26.5	1.70
	(33.5)	(10.8)	(1.61)	(0.055)	(44.2)	(7.32)
For-Profit	-20.6	-2.04	-1.90	0.065	35.3	-8.08
	(31.6)	(8.17)	(0.791)*	(0.064)	(64.5)	(6.50)
Adj. R-squared	0.275	0.02	0.02	0.053	0.048	0.279
Observations	373	373	373	365	373	362

[a]Notes:

1. All regressions include county fixed effects as well as the age of the hospital, age of the hospital squared, the number of licensed beds in 1992 (or the earliest year available, with an indicator to account for such substitution), 1992 ownership status (government-owned or for-profit, with nonprofit status excluded), rural status, multi-system status, and 1996 teaching status. Teaching status is measured as of 1996 because of data limitations.
2. Standard errors are clustered at the county level. We denote significance at the 10%, 5% and 1% levels as +, * and **, respectively.
3. Days and discharges are measured in units of 1,000
4. Data on % Bed Staffed are available only starting in 2002, so column 4 represents the change between 2006 and 2002.

No overall net change in service provision.

Predicted Response

	Profitable Care (q)	Uncompensated Care (u)	Distortionary Perquisites (θ)
FPID	0	0	0
Perquisite	+	0	-
Output	+/-	+/-	+/-
Altruism	-	-	-

Results for Uncompensated Care

Changes in Uncompensated Care: 2002-2006 [a]

	Total Inpatient Days	*GAC Inpatient Days*	*ER Visits*	*Clinic Visits*
pga	1.94	7.64	1.33	25.7
	(6.31)	(4.30)+	(13.4)	(20.3)
pga * Public	-47.2	-23.7	34.1	-80.0
	(33.2)	(15.4)	(25.4)	(61.3)
pga * For-Profit	-3.25	-43.37	-19.4	-28.6
	(10.1)	(7.60)	(11.3)	(18.9)
Public	23.8	4.51	-14.0	40.5
	(15.8)	(7.65)	(10.7)	(33.2)
For-Profit	4.37	3.41	10.8	14.5
	(5.21)	(3.79)	(6.48)	(11.0)
Adj. R-squared	0.11	0.018	0.08	0.04
Observations	365	365	365	365

"Notes:

1. All regressions include county fixed effects as well as the age of the hospital, age of the hospital squared, the number of licensed beds in 1992, 1992 ownership status (government-owned or for-profit, with nonprofit status excluded), rural status, multi-system status, and 1996 teaching status. Teaching status is measured as of 1996 because of data limitations.
2. Standard errors are clustered at the county level. We denote significance at the 10%, 5% and 1% levels as +, * and **, respectively.
3. GAC stands for "General Acute Care"
4. Total inpatient days includes GAC days as well as inpatient days for psychiatric care, chemical dependency, rehabilitation, long-term care, and "other care."
5. Days and visits are measured in units of 100.
6. Uncompensated care does not include care compensated under the county indigent care programs.

Nonprofit hospitals have a weak positive correlation between seismic risk and charity care.

Predicted Response

	Profitable Care (q)	Uncompensated Care (u)	Distortionary Perquisites (θ)
FPID	0	0	0
Perquisite	+	0	-
Output	+/-	+/-	+/-
Altruism	-	-	-

Results for Profitable Care

Changes in MRI: 2002-2006 [a]

	Total MRIs	*Inpatient MRIs*	*Outpatient MRIs*
pga	118	12.6	105
	(50.9)*	(35.0)	(43.1)*
pga * Public	-148	-74.6	-73.0
	(127)	(56.3)	(90.4)
pga * For-Profit	-99.5	-2.34	-102
	(95.4)	(66.4)	(51.5)+
Public	73.8	47.2	26.7
	(67.2)	(28.9)	(47.9)
For-Profit	86.4	28.8	57.6
	(50.9)+	(37.4)	(27.6)*
Adj. R-squared	0.01	0.04	0.07
Observations	365	365	365

[a]Notes:

1. MRIs are measured in units of 100.
2. All regressions include county fixed effects as well as the age of the hospital, age of the hospital squared, the number of licensed beds in 1992, 1992 ownership status (government-owned or for-profit, with nonprofit status excluded), rural status, multi-system status, and 1996 teaching status. Teaching status is measured as of 1996 because of data limitations.
3. Standard errors are clustered at the county level. We denote significance at the 10%, 5% and 1% levels as +, ∗ and ∗∗, respectively.

MRI use increases for nonprofit hospitals facing higher seismic risk.

Results for Profitable Care

Changes in NICU and Obstetrics Care [a]

	NICU Beds	*NICU Days*	*NICU Discharges*	*Obstetrics Beds*	*Obstetrics Days*	*Obstetrics Discharges*
pga	4.77	2207	30.5	0.666	1438	611
	(4.34)	(877)*	(104)	(8.43)	(845)+	(314)+
pga * Public	-7.58	-1313	-186	-6.70	-2219	-1334
	(3.92)+	(1555)	(191)	(7.93)	(1598)	(714)
pga * For-Profit	-4.33	-152	-132	-4.21	-877	-301
	(2.72)	(1005)	(113)	(7.85)	(1087)	(512)
Public	3.94	-152	82.4	3.41	996	627
	(3.35)	(1004)	(114)	(3.86)	(741)	(361)
For-Profit	-1.35	-72.6	-8.40	4.04	596	209
	(1.72)	(55.0)	(66.1)	(4.84)	(632)	(308)
Adj. R-squared	0.07	0.03	0.101	0.134	0.03	0.044
Observations	373	373	373	365	365	365

[a]Notes:

1. NICU data are from the AUR and include the years 2006 and 1992. Obstetrics care are from the HAFD and cover 2002 and 2006.
2. All regressions include county fixed effects as well as the age of the hospital, age of the hospital squared, the number of licensed beds in 1992, 1992 ownership status (government-owned or for-profit, with nonprofit status excluded), rural status, multi-system status, and 1996 teaching status. Teaching status is measured as of 1996 because of data limitations.

Higher seismic risk nonprofit hospitals increase NICU days.

Results for Profitable Care

Changes in CABG, Catheterizations, and PTCA [a]

	CABG	*Therapeutic Catheterization*	*Therapeutic Net Dx Catheterization*	*PTCA*	*PTCA Net W/O Stents*
pga	39.8	236	325	164	179
	(27.9)	(181)	(135)*	(92.7)+	(63.4)**
pga * Public	18.8	-156	-376	-133	-144
	(54.4)	(194)	(202)+	(170)	(158)
pga * For-Profit	15.0	176	-206	-50.8	-260
	(36.9)	(317	(414)	(104)	(118)
Public	0.45	-83.6	104	-26.0	-17.5
	(32.8)	(96.1)	(124)	(82)	(98.3)
For-Profit	-15.0	-207	98.2	-52.8	17.5
	(24.2)	(140)	(204)	(50.2)	(98.3)
Adj. R-squared	0.15	0.03	0.05	0.03	0.02
Observations	365	373	373	373	365

[a]Notes:

1. All regressions include county fixed effects as well as the age of the hospital, age of the hospital squared, the number of licensed beds in 1992, 1992 ownership status (government-owned or for-profit, with nonprofit status excluded), rural status, multi-system status, and 1996 teaching status. Teaching status is measured as of 1996 because of data limitations.
2. Standard errors are clustered at the county level. We denote significance at the 10%, 5% and 1% levels as +, * and **, respectively.
3. Catheterization and PTCA data are available in the AUR and include the years 2006 and 1992. CABG data and information on stents are from the HAFD and cover 2002 and 2006.
4. "Therapeutic Net Dx" means net of diagnostic catheterizations. "Net W/O Stents" means net of PTCA procedures where stents are not placed.

Cardiac surgical procedures increase with an increase in seismic risk.

Conclusion

Hospital Reactions to Mandate

- Higher seismic risk hospitals more likely to close
- Nonprofits increase spending on property, plant, and equipment
- Private nonprofits increase profitable services

Nonprofit Hospital Objectives

- Reject FPID and altruism as potential objective functions
- Welfare implications are ambiguous

Discussion

1. Unable to separate types of nonprofit hospitals
2. Do not have a measure of expected cost of the mandate for each hospital
3. Assume seismic risk is "randomly" assigned to geographically proximate hospitals
4. Find evidence of differential mandate compliance by ownership type