Is hospital Competition Wasteful?

Dranove, Shanley and Simon (1992)

November 7, 2022

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- Competition $\implies$ duplication of capital-intensive services $\therefore$ raising costs of care.
- Duplication of services $\implies$ quality of care to fall $\because$ providers cannot take advantage of scales and learning effects.

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- MAR was embraced by the media at the time.
- Motivated calls to nationalize the provision of hospital services.
- Played a role in hospital antitrust decisions.
  - Courts seems to incorporate this hypothesis in their decisions on mergers.

Research Question

Alternative hypothesis: the number of providers of a particular high-tech service will be determined by the *"extent of the market."*

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- Controlling for the extent of the market, does the MAR matter on the margin?

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- Controlling for the extent of the market, does the MAR matter on the margin?
- Is the magnitude of the MAR sufficient to warrant policy interest?

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  - Modelling the supply of specialized services
- Estimate the empirical relation between the number of providers in a market, supply and demands factors, and competitive structure.

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   - Local population, proximate population, distance to market $\Rightarrow$ predict patterns of service provision.
5. Estimation results consistent with Bresnahan and Reiss (1991).

Challenging the MAR hypothesis.

1. Most empirical work focuses on costs.
2. Inadequate attention to market definitions.
3. Scale and scope are not explored as alternative explanations for the observed differences in costs and specialized service supply across markets.

Econometrics and Identification

What determines the number of providers of specialized services in local markets?

Ordered probit model

For each specialized service, i, in each market, j:

$$N_{i,j} = f \text{ (Demand Shifters, Supply Shifters, Competition)}$$

- $N_{i,j}$, is the number of providers of service i in market j.
- The number of providers is a categorical variable with **M** response categories, $m_1, m_2, \ldots m_M$.
- $\mathbf{F}(\cdot)$ and let $\mu_1 = 0$. Then,

$$\Pr[m_k] = \mathbf{F}[\mu_k - \mathbf{X}\beta] - \mathbf{F}[\mu_{k-1} - \mathbf{X}\beta].$$

MLE yields the parameters $\mu_1 \ldots \mu_{m-1}$ and the coefficient vector β.

Data

Using 1983 data from the California Office of Statewide Health Planning,

Market: urbanized area and all cities with population $> 5000.\backslash$ not in an urbanized area

- 87 local markets (not counting LA and SF and 16 markets without hospitals)

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- Using 1989 Rand McNally Road Atlas to determine highway distance between cities or distance to the nearest larger urbanized area.

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Specialized Service: subset from the 171 hospital services that are high-tech and associated with MAR. Each of these categories has substantial fixed costs so that duplication would be economically wasteful.

Cardiology
Deliveries
Diagnostics
Emergency
Neonatology
Pediatrics
Teaching
CT scans
Open-heart surgery
Radiation therapy
Radioisotope therapy

Econometrics and Identification

The unit of analysis is the market.

Ordered probit model

$$N_{i,j} = \beta_0 + \beta_1 POP + \beta_2 FRINGEPOP + \beta_3 DISTANCE \\ + \beta_4 INCOME + \beta_5 \text{ LABORCOST } + \beta_6 HERF^*$$

- $N_{i,j}$, is the number of hospitals in market i that are defined to be a specialized provider of service j.
- POP, natural log of population (1980 census)
- INCOME, mean family income (1980 census)
- LABORCOST, average expenditure for **aides** and **orderlies** per bed in thousands.
- HERF, Herfindahl index based on patient discharges.

Results

TABLE 1 Descriptive Statistics for Independent Variables

Variable	Mean	Median	Standard Deviation	Range
POP[a]	2.05	.31	9.4	.01 to 94.8
FRINGEPOP[b]	.42	.09	1.2	.005 to 11.6
DISTANCE	47.4	22	38.6	8 to 376
INCOME (000's)	1.92	1.8	.29	1.4 to 3.0
JANCOST[c]	3.17	2.7	1.44	0.6 to 8.7
HERF	74	100	30	3 to 100

[a] Population in 100,000s. Variables were scaled such that the independent variable set was of approximately the same magnitude. This increases the efficiency of the nonlinear ordered probit estimation techniques.

[b] Fringe population in 100,000s. Markets with no fringe population were coded as .01.

[c] Average expenditures on janitors, aides, and orderlies per bed. In $1000s.

Sources: Census of the Population, 1980 (*POP, FRINGEPOP, INCOME*); *Rand McNally Road Atlas of California* (*DISTANCE*); California Office of Statewide Health Planning and Development (OSHPD); Annual Financial Disclosure Reports (*JANCOST, HERF*).

Results

TABLE 2 Probit Results: Demand Coefficients

Service	*POP*	*FRINGEPOP*	*DISTANCE*	*INCOME*	*JANCOST*	*HERF*
Cardiology	.741[c]	.217	.078	−.148	.033	−.009
	(2.40)	(1.57)	(.32)	(−.17)	(0.13)	(−.07)
Deliveries	.503[c]	.119[a]	.149	−.541[a]	.119	−.010
	(2.92)	(1.69)	(.70)	(−1.81)	(.71)	(−.22)
Diagnostics	1.430[c]	.078[a]	.166	−.580	.196	−.018[a]
	(4.34)	(1.60)	(.43)	(−.93)	(.78)	(−1.63)
Emergency	.319[a]	.036	−.114	.550	−.222	−.016[b]
	(1.83)	(.07)	(−.05)	(.95)	(−1.44)	(−2.14)
Neonatology	.779[c]	.166[a]	.125	−.149	−.104	−.008
	(3.07)	(1.87)	(1.12)	(−.44)	(−.58)	(−.49)
Pediatrics	.689[c]	.109[a]	.416[a]	.389	.057	−.016
	(3.85)	(1.83)	(1.65)	(.85)	(.44)	(−1.04)
Teaching	3.91[a]	−.223	.564	−.229	−1.66	.007
	(1.83)	(−.52)	(1.31)	(−.08)	(−.89)	(.11)
CT scans	.708[a]	.077	.132	.118	−.210	−.017
	(1.94)	(.56)	(.39)	(.19)	(−.74)	(−1.30)
Open-heart surgery	.841[a]	.066	−.088	1.50	.449	−.023
	(1.99)	(.92)	(−.09)	(1.14)	(.065)	(−.48)
Radiation therapy	.674[c]	.063	.413[a]	.190	.008	−.006
	(2.44)	(.44)	(1.84)	(.26)	(.03)	(−.55)
Radioisotope therapy	1.518[c]	.295[a]	.032	−.347	.129	−.008
	(2.69)	(1.77)	(.10)	(−.26)	(.51)	(−.89)
Joint test	+[c]	+[b]	+[b]	0	0	−[a]

[a] Significant at $p < .10$.
[b] Significant at $p < .05$.
[c] Significant at $p < .01$.
Note: These coefficients are obtained from ordered probit estimates. The dependent variables were obtained from OSHPD; the independent variables are described in Table 1. *t*-statistics are in parentheses.

Threats

$$N_{i,j} = \beta_0 + \beta_1 POP + \beta_2 FRINGEPOP + \beta_3 DISTANCE \\ + \beta_4 INCOME + \beta_5 \text{ LABORCOST } + \beta_6 HERF^*$$

- *HERF* is endogenous.

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- $\therefore$ *HERF* is picking up omitted variable bias associated with the extent of the market.

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- $\therefore$ *HERF* is picking up omitted variable bias associated with the extent of the market.
- Can't separate the MAR effect from the extent of the market.

Results

TABLE 3 Bias in *HERF* When *FRINGEPOP* and *DISTANCE* are Omitted

Service	Full Model	*FRINGEPOP* and *DISTANCE* Omitted	Bias
Cardiology	−.009	−.016[a]	−.007
Deliveries	−.010	−.017[a]	−.007
Diagnostics	−.018[a]	−.022[b]	−.004
Emergency	−.016[a]	−.017[b]	−.001
Neonatology	−.008	−.013[a]	−.005
Pediatrics	−.016	−.021[a]	−.005
Teaching	.007	−.005	−.012
CT scans	−.017	−.019[a]	−.002
Open-heart surgery	−.023	−.026	−.003
Radiation therapy	−.006	−.017[a]	−.011
Radioisotope therapy	−.008	−.009	−.001

[a] Significant at $p < .10$.
[b] Significant at $p < .05$.
[c] Significant at $p < .01$.

Note: The first column reports the coefficients on *HERF* from the ordered probit in Table 2. The next column reports the coefficients on *HERF* when the ordered probit is reestimated without the variables *FRINGEPOP* and *DISTANCE*. The last column

Results

TABLE 4 **Effect of a One-Standard-Deviation Increase in the Independent Variables on the Number of Services in a Market**

Service	Mean Providers[a]	*POP*	*FRINGEPOP*	*DISTANCE*	*INCOME*	*JANCOST*	*HERF*
Cardiology	1.9	1.0	.5	0	0	0	0
Deliveries	2.0	1.0	.5	0	0	0	−.5
Diagnostics	2.2	1.5	.5	0	0	.5	−.5
Emergency	1.6	0.5	0	0	0	0	−.5
Neonatology	2.1	1.5	.5	0	0	0	0
Pediatrics	.91	1.0	0	.5	0	0	0
Teaching	.70	1.5	0	0	0	−.5	0
CT scans	1.8	1.0	0	0	0	0	0
Open-heart surgery	1.4	1.0	0	0	.5	.5	0
Radiation therapy	1.2	0.5	0	.5	0	0	0
Radioisotope therapy	1.7	1.0	.5	0	0	0	0

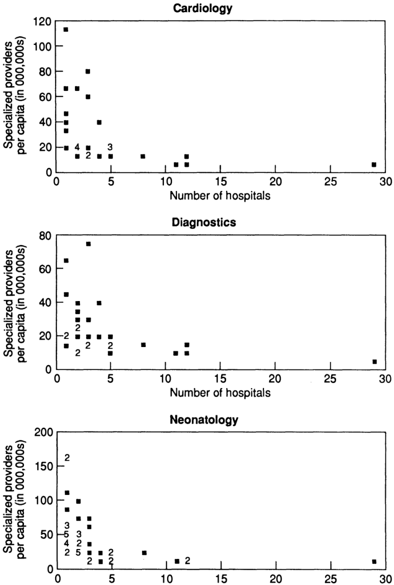
Note: Marginal effects computed holding all independent variables at their mean values. Rounded to nearest one-half service provider.

[a] Mean number of specialized providers per service per market.

Results

FIGURE 1

SPECIALIZED PROVIDERS PER CAPITA BY NUMBER OF HOSPITALS



Results

TABLE 5 **Population Necessary to Support *N* Services Per Market (in 1000s)**

	Number of Services				
Service	1	2	3	4	5
Cardiology	62	277	974	1653	2482
Deliveries	19	158	377	*	1881
Diagnostics	46	101	204	328	508
Emergency	19	458	1180	2171	*
Neonatology	25	130	476	*	1014
Pediatrics	84	481	1026	*	2001
Teaching	87	240	395	*	*
CT scan	66	232	*	529	779
Open-heart surgery	96	490	889	*	1631
Radiation therapy	145	501	885	*	2061
Radioisotope therapy	45	281	499	856	*

* No observations for this service level.