

Dafny, 2005, How Do Hospitals Respond to Price Changes?

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August 31, 2022

- How do hospitals respond to price changes?
 - ((Understanding supply function in hospital market))
 - ((Do they differ by ownership type?))
- Understand the behavior of hospitals related to profit.
 - ((Their profit-seeking behaviors differ by Ownership types/Financial status, etc))
- Exploits exogenous price change due to the policy change in 1988.
 - Fundamental problem of demand/supply estimation?
- In a nutshell,

$$\text{Hospital Behavior} = \alpha \cdot \text{Price Change} + X'\beta + u$$

<Simplified Table Here >

Finding here

Prospective Payment System (PPS)

- Under PPS, implemented in 1984, Hospitals receive a pre-determined fixed amount of money for a given DRG from Medicare:

$$P_{hd} = P_h \cdot (1 + IME_h) \cdot (1 + DSH_h) \cdot DRG\ weight_d$$

((Most of the variation of P_{hd} comes from DRG weight.))

((DRG weighted is recalibrated annually by a central authority (HCFA) reflecting average cost change))

- 1% increase in average case weight is associated with an additional 930 million in annual Medicare payments to hospitals.
- Incentive to 'upcoding' ('Nominal')
- P_{hd} is low relative to actual costs \Rightarrow Reduce admission of d ('Real')

How DRG looks like

- 473 DRG codes in 1987

Example:

Code	Description
82	Traumatic stupor and coma > 1 hour with MCC
83	Traumatic stupor and coma > 1 hour with CC
84	Traumatic stupor and coma > 1 hour w/o CC/MCC
85	Traumatic stupor and coma < 1 hour with MCC
86	Traumatic stupor and coma < 1 hour with MCC
87	Traumatic stupor and coma < 1 hour w/o CC/MCC

<https://www.aapc.com/codes/drg-codes-range/2/40>

Table: DRG code 082-087 in 2022

((Explain DRG weight: top-code has a greater weight))
((Explain upcoding))

Policy Change in 1988

No more "age 69 and below / 70 and above"

Example:

DRG code	Desc. in 1987	Desc. in 1988
96	Bronchitis and asthma age > 69 and/or CC	B&A age > 17 with CC
97	B&A age 18-69 w/o CC	B&A age > 17 w/o CC
DRG code	weight in 1987	weight in 1988
96	0.8446	0.9894
97	0.7091	0.7151

Policy Change in 1988

Consider assigning DRG code 69 and 70:

1987	CC	no CC
70+	96	96
69-	96	97

1988	CC	no CC
70+	96	97
69-	96	97

$\Rightarrow \begin{cases} \text{DRG 96: more risky } (\because \text{proportion of } 70+/\text{CC} \uparrow) \\ \text{DRG 97: less(?) risky (why? maybe upcoding/recalibration?)} \end{cases}$

Two Questions

((For whatever reason))

As a result of the policy reform,

$$\begin{cases} \text{DRG weights of top codes } \uparrow \\ \text{DRG weights of bottom codes } \downarrow \end{cases} \Rightarrow \text{Spread } \uparrow$$

In response,

1. did hospitals increase their upcoding practices?
2. did hospitals change their intensity of care/admission volumes?

- 1985-1991 ((3 years before and after the policy change))
- 20-percent Medicare Provider Analysis and Review (Med-PAR)
 - Patient demographics, DRG code, length of stay, number of surgeries, hospital identification number.
- DRG weights
- Medicare Cost Reports
 - Hospital financial data
- Annual Survey of Hospitals by the American Hospital Association
 - Hospital characteristics.

TABLE 2—DESCRIPTIVE STATISTICS

Unit of observation	DRG pair-year			Hospital-year		
	<i>N</i>	Mean	<i>SD</i>	<i>N</i>	Mean	<i>SD</i>
Price (DRG weight)	650	1.12	0.62	36651	1.27	(0.19)
Admissions per cell	650	10624	(15013)	36651	373	(389)
Nominal responses						
Fraction(young) in top code	650	0.66	(0.14)			
Fraction(old) in top code	650	0.85	(0.15)			
Real responses						
Mean cost (\$)	650	9489	(6230)	36169	12272	(5692)
Mean LOS (days)	650	9.37	(3.32)	36651	8.81	(2.21)
Mean surgeries	650	1.15	(0.69)	35897	1.21	(0.55)
Mean ICU days	650	0.51	(0.65)	28226	0.81	(0.59)
Death rate	650	0.06	(0.06)	34992	0.06	(0.02)
Mean admissions	650	31806	(25822)	36651	778	(538)
Instruments						
Δ spread	650	0.20	(0.16)			
Δ spread \cdot post	650	0.12	(0.16)			
$\Delta \ln(\text{Laspeyres price})$	650	0.03	(0.06)			
$\Delta \ln(\text{Laspeyres price}) \cdot \text{post}$	650	0.01	(0.05)			
Share CC				36651	0.09	(0.03)
Share CC \cdot post				36651	0.05	(0.05)

Nominal Response (Upcoding)

$$\begin{aligned} spread_{pt} &= DRG \text{ weight in top code}_{pt} \\ &\quad - DRG \text{ weight in bottom code}_{pt} \end{aligned}$$

$$fraction_{pt} = \alpha + \sigma pair_p + \delta year_t + \psi \Delta spread_{p,88-87} \cdot post + \epsilon_{pt}$$

- p : pair of codes, 95 pairs
- t : 1988-1991
- $fraction_{pt}$: the fraction of the top-coded in each pair p
- Estimate for each young (69-) and old (70+) group

Nominal Response (Upcoding)

TABLE 3—EFFECT OF POLICY CHANGE ON UPCODING
($N = 650$)

	Fraction(young) mean = 0.66	Fraction(old) mean = 0.85
$\Delta \text{spread}_{88-87} \cdot \text{post}$	0.077*** (0.016)	0.108*** (0.015)
Fraction(young) $_{87} \cdot \text{post}$		0.731*** (0.020)

Figure: Estimation results of nominal responses

* For detailed results, refer to Table 3 & 4 of the paper.

$$L_{138/139,1988} = \frac{p_{138,88} \cdot N_{138,87} + p_{139,88} \cdot N_{139,87}}{N_{138,87} + N_{139,87}}$$

$$\ln(\text{price})_{pt} = \alpha + \sigma \text{pair}_p + \delta_{\text{year}_t} + \kappa_1 \Delta \ln(L)_{p,88,87} \cdot \text{post} \\ + \zeta \text{pair}_p \cdot \text{year} + \epsilon_{pt}$$

$$\ln(\text{hospital})_{pt} = \alpha + \sigma \text{pair}_p + \delta_{\text{year}_t} + \kappa_2 \Delta \ln(L)_{p,88,87} \cdot \text{post} \\ + \zeta \text{pair}_p \cdot \text{year} + \epsilon_{pt}$$

- $L_{p,88}$: Laspeyres price to correct composition change
- κ_2/κ_1 : price \rightarrow outcome where price is instrumented by $\Delta \ln L$

TABLE 5—REAL RESPONSES TO CHANGES IN DRG PRICES
($N = 650$)

	Dependent variable					
	ln(cost) mean = \$9,489	ln(LOS) mean = 9.37	ln(surgeries) mean = 1.15	ln(ICU days) mean = 0.51	ln(death rate) mean = 0.06	ln(volume) mean = 31,806
Reduced form						
$\Delta \ln(\text{Laspeyres price}) \cdot \text{post}$	-0.207 (0.133)	0.073 (0.146)	0.009 (0.158)	-0.642 (0.380)	-0.381 (0.352)	0.245 (0.272)
IV estimate						
ln(price)	-0.223 (0.147)	0.079 (0.157)	0.009 (0.171)	-0.694 (0.425)	-0.412 (0.383)	0.265 (0.285)

- What is the impact of upcoding on the economy?
- Then how do hospitals seek profit without changing their medical practice?

The study found, by using the exogenous price shock, ...

- Hospitals do “upcoding” more for the DRG pairs that have a higher spread.
- Hospitals do not seem to change their medical practice just for cost.

Dafny, 2005, How do hospitals respond to price changes, American Economics Review