

Money for nothing?

The net costs of medical training

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October 2009

Introduction

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Background

- ▶ **Should we compensate a primary/secondary care provider for hosting residents?**

- ▶ Hosting institutions often claim compensation for providing medical training

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- ▶ Account for both costs and benefits of training interns to measure the net costs of medical training
 - ▶ Spend extra time and resources?
 - ▶ Physician - cost or benefit to supervise interns?
 - ▶ Lower wage
 - ▶ Perform other tasks (sutures, blood tests, ...)

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- ▶ Net effect?

Literature review

- ▶ Graduate Medical Education (GME) funding - Direct and indirect medical education costs
 - ▶ Thorpe (1988), Rogowski and Newhouse (1992), Dalton and Norton (2001) - estimate indirect costs (goal: Medicare reimbursement formula)
 - ▶ Song and Nicholson (2001) - incentive effects of Medicare payment system
 - ▶ Blumenthal et al (1997) - indirect costs include diagnostic and therapeutic services, extra time to perform routine tasks and faculty supervision

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 - ▶ Blumenthal et al (1997) - indirect costs include diagnostic and therapeutic services, extra time to perform routine tasks and faculty supervision
 - ▶ \Rightarrow no clear picture emerges

Literature review

- ▶ Efficiency effects of Graduate Medical Education
 - ▶ Higher cost level for teaching hospitals - Sloan et al. (1993) and Farsi and Filippini (2008)
 - ▶ Jensen and Morrissey (1986) - differences in production of teaching and non-teaching hospitals
 - ▶ Stochastic frontier analysis - review by Rosko (2004); Linna and Hakinnen (2006)
 - ▶ Data envelopment analysis - Grosskopf et al. (2001); Jacobs (2001) compares the two techniques

Graduate Medical Education

- ▶ common features
 - ▶ 2 stages
 - ▶ matching between residents and hosting institutions

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- ▶ **Portugal**
 - ▶ Ministry of Health and National Council for medical residencies
 - ▶ determine *supply and demand* for residents

Cost function analysis

Inputs

- ▶ Medical care production

- ▶ Labor

1. medical input: physicians (L_1) and interns (L_2)

$$\mathbf{L}_m = L_1 + \beta L_2 \quad (1)$$

2. nursing input: nurses (L_3) and interns (L_2)

$$\mathbf{L}_n = L_3 + \theta L_2 \quad (2)$$

- ▶ Other factors: facilities, beds, laboratory tests, diagnosis procedures, medical devices, ...

Cost function analysis

optimization problem

- ▶ An institution's optimization problem is given by

$$\begin{aligned} \min_{L_1, L_3, K} \quad C &= \sum_{i=1}^3 w_i L_i + rK & (3) \\ \text{s.t.} \quad G(q_1, q_2, q_3) &= F(L_1 + \beta L_2, L_3 + \theta L_2, K) \end{aligned}$$

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- ▶ measure the impact of residents on costs

Cost function

$$C_i = \omega R_i + \Gamma X_i + \varepsilon_i \quad (5)$$

- ▶ R_i is exogenous
- ▶ $X_i \Rightarrow$ outputs

Hospital (2002, 2003, 2004)		Primary Care Centre (2005)	
Discharges	Medical School	Scheduled visits	SRS
Outpatients	Yearly dummies	SAP episodes	\bar{w}_1
Emergency room	SA	Exams	\bar{w}_3
Case-mix index	RHA	Age group dummies	

Hospitals

Table: Hospitals - total cost function estimation

Variable	OLS		Frontier		Robust	
	Full	Sign coef	Full	Sign coef	Full	Sign coef
Residents	0.001**	0.001**	0.001*	0.001**	0.001*	0.001**
R 3Q beds	-0.002*	-0.002*	-0.002*	-0.002*	-0.002*	-0.002*
Outpatients	0.522**	0.513**	0.522**	0.488**	0.512**	0.477**
Discharges	0.374**	0.394**	0.374**	0.426**	0.365**	0.426**
Case mix	0.383**	0.393**	0.383**	0.419**	0.408**	0.463**
RHA Centro	-0.127*	-0.122*	-0.127**	-0.158**	-0.192**	-0.216**
RHA Norte	-0.196**	-0.199**	-0.196**	-0.221**	-0.218**	-0.240**
Level 2	-0.242**	-0.240**	-0.242**	-0.222**	-0.191**	-0.186**
Level 1	-0.385**	-0.377**	-0.385**	-0.348**	-0.362**	-0.326**
Constant	8.383**	8.326**	8.382**	8.311**	8.554**	8.469**
N	202	202	202	202	202	202
R ²	0.9727	0.9724				
P-value restr	0.815		0.351		0.190	
Significance levels : † : 10% * : 5% ** : 1%						

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- ▶ Outpatient visits and inpatient discharges are the main cost drivers
- ▶ ER episodes don't have a systematic relationship with costs
- ▶ Higher case-mix \Rightarrow higher costs
- ▶ Costs are higher in the south and in central hospitals

Primary Care Centres

Table: Primary Care Centres - total cost function estimation

Variable	OLS		Frontier		Robust	
	Full	Sign coef	Full	Sign coef	Full	Sign coef
R 2Q physicians	-0.072**	-0.069**	-0.071*	-0.076*	-0.077*	-0.075*
R 4Q physicians	0.007 [†]	0.007*	0.007	0.007 [†]	0.007 [†]	0.007 [†]
Scheduled visits	0.870**	0.868**	0.872**	0.872**	0.865**	0.868**
SAP episodes	0.015**	0.015**	0.015**	0.015**	0.013**	0.012**
Age ≤ 18	-0.010	-0.011*	-0.010*	-0.011**	-0.006	
Age ≥ 65	0.001		0.001		0.005*	0.006**
w ₁	0.155*	0.163*	0.154**	0.165**	0.098*	0.108**
w ₃	0.142*	0.148*	0.142**	0.146**	0.150**	0.151**
Constant	-10.804**	-10.899**	-10.876**	-11.016**	-10.348**	-10.639**
(...)						
N	292	292	292	292	292	292
R ²	0.962	0.9616				
P-value restr	0.977		0.846		0.313	

Significance levels : † : 10% * : 5% ** : 1%

The variable Residents was not included in the estimation due to collinearity.

Residents - average marginal effect

Table: Hospitals - net effect

	All hospitals				Teaching hospitals			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
OLS	-4,183€	-29,723€	-116.4%	-0.057%	11,371€	-14,169€	-55.5%	-0.022%
Frontier	15,243€	-10,297€	-40.3%	-0.020%	18,929€	-6,611€	-25.9%	-0.010%
Robust	14,518€	-11,022€	-43.2%	-0.021%	18,015€	-7,525€	-29.5%	-0.012%

(1) average marginal effect

(2) net effect = average marginal effect - reference annual wage (resident)

(3) percentage of resident's wage

(4) percentage of total costs

Residents - average marginal effect

Table: Primary Care Centres - net effect

	All primary care centres				Teaching primary care centres			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
OLS	-38,219€	-63,759€	-249.6%	-0.93%	20,670€	-4,870€	-19.1%	-0.05%
Frontier	-45,074€	-70,614€	-276.5%	-1.03%	15,849€	-9,691€	-37.9%	-0.10%
Robust	-43,858€	-69,398€	-271.7%	-1.01%	17,694€	-7,846€	-30.7%	-0.08%

(1) average marginal effect

(2) net effect = average marginal effect - reference annual wage (resident)

(3) percentage of resident's wage

(4) percentage of total costs

What about the real world?

- ▶ Interviews with interns - typical weekly workload
 1. 12h spent in ER
 2. 10h paperwork
 3. 8h with the supervisor
 4. 5h study
 5. 7h visiting patients and talking to their families
- ▶ not as good as senior doctors - spend more time and resources
- ▶ overall, enhance workload distribution
- ▶ in line with the econometric results

Final remarks

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- ▶ Training costs above wage costs are relatively small
- ▶ Residents contribute to production, compensating for the extra resources (both capital and labor) they consume
- ▶ Drawbacks - quality of the data; no panel data