

On the use of LOS to Define Heterogeneous Prospective Payments

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Background

- Lump-sum payments per stay
 - Computed per stay in a given DRG
 - Average cost per DRG
 - Computed on a cost database: sub-sample of voluntary hospitals
 - In Switzerland, roughly, average cost per stay per DRG
 - Outliers excluded using thresholds computed by the financing administration
 - Use of a multiplier (1.24) by the administration for non teaching hospitals

Background

- Lump-sum payments do not take the heterogeneity of patients and hospitals into account
 - Patient selection, Quality of care
- Data used to set lump-sum payments per stay
 - Lack of representativeness

Purpose of the paper

- Improve computation of payments by combining two sources of information:
 - Payment adjusted for the non-representativeness of the data
 - Payment that takes the heterogeneity of patients and hospitals into account
 - Heterogeneous payment that still creates incentives to increase hospital efficiency without reducing quality of care

Two databases

- Stays for vaginal or C-sections deliveries in Swiss hospitals
 - Sub-sample relative to cost:
 - A three dimensional nested database
 - 12,123 stays
 - 7 hospitals
 - Years 1999-2001
 - Information about costs per stay, LOS, diagnoses, procedures
 - Exhaustive database: concerns all Swiss hospitals
 - 129,495 stays
 - 80 hospitals
 - Year 2002
 - No information about costs
- Hereafter, sub-sample versus exhaustive database

DRGs

- 4 DRGs relative to deliveries
 - DRG 370 and 371, i.e. C-section deliveries with low risk, with or without complications
 - Surgical
 - DRG 372 and 373: vaginal deliveries with or without complications
 - Medical
 - DRG 373: by far the most frequent (42% of stays)

Basic features of the data

	Swiss-DRG database (7 hospitals; 1999-2001) 12 123 stays			Swiss-DRG database (7 hospitals; 2001) 3 437 stays		OFS database (80 hospitals; 2002) 29 495 stays	
DRG	# stays	Average Cost ¹	Average LOS	# stays	Average LOS	# stays	Average LOS
370	344	9 910	8.67	118	8.75	2 168	8.51
371	2 009	7 575	7.55	632	7.38	8 848	7.91
372	2 362	4 060	5.51	785	5.31	6 095	5.82
373	7 408	3 823	5.25	1 902	5.13	12 384	5.42

1: Swiss Francs (CHF)

- » Only two area i.e. “cantons” in the Swiss-DRG database
- » Quite similar LOS in the two databases whatever the DRG

Distortions arising from the use of a sub-sample

- A straightforward improvement could be the following:
 - (i) Using the hospital sub-sample to evaluate the link between the cost of a stay in a given DRG and the length of stays and patient characteristics
 - (ii) Taking the information about LOS and patient characteristics (available in the exhaustive database) to predict the costs per stay for all hospitals
 - (iii) Compute the corresponding average costs

Distortions arising from the use of a sub-sample

- Three steps

(i)
$$C_{iht} = \gamma + D_{iht}\alpha + X'_{iht}\beta + \eta_h + \zeta_{iht}$$

(ii)
$$\tilde{C}_{ih} = E(C_{ih}|D_{ih}, X'_{ih}) = \hat{\gamma} + D_{ih}\hat{\alpha} + X'_{ih}\hat{\beta}$$

- (iii) Compute the corresponding average costs

Distortions arising from the use of a sub-sample

		DRG	370	371	372	373
OFS database (Hospitals/ $N_{it} \geq 20$)	(1)	M1 Average cost computed using OFS database (Using the estimate of $E(C/D, X)$)	7 483	6 764	4 428	3 983
Swiss-DRG database	(2)	M2 Average cost computed using Swiss-DRG database Relative difference with respect to M1	9 910 + 32.4 %	7 575 + 12.0 %	4 060 - 8.3 %	3 823 - 4.0 %
	(3)	M124 Average cost computed using Swiss-DRG database, with correction 1.24 Relative difference with respect to M2 Relative difference with respect to M1	10 627 +7.2 % + 42.0 %	8 549 + 12.8 % + 26.4 %	4 407 + 8.5% -0.5 %	4 481 + 17.2 % + 12.5 %

Swiss-DRG database: 7 hospitals, 12 123 stays, years 1999-2001

OFS database: 80 hospitals, 29 495 stays, year 2002 , OFS database / $N_{it} \geq 20$: 77 hospitals, 29 128 stays.

Conclusions 1

- M1: Our estimation of the cost
- M124: Currently computed average cost
- Comparison of means M1 and M2
 - Overestimation of the average cost for C-section deliveries
 - Underestimation for vaginal deliveries
 - The differences are quite sizeable: + 32.4 % for DRG 370 and - 8.3 % for DRG 372
- Comparison of means M1 and M124
 - Reinforces the overestimation of the cost of C-sections
 - Compensates for the underestimation of the cost of vaginal deliveries (spectacular for DRG 373 : -4 to +12.5)
 - DRG 373: the most frequent → a sizeable impact on hospital expenditures

Conclusions 1(continued)

Using M2 or M124 instead of M1

- Actual practice not representative of average cost per stay
- The distortion is not homogenous among DRGs
- Incentives for an increasing use of C-sections
- We propose a very simple method to improve the relevance of the computed average costs per DRG

Issue of hospital heterogeneity (1)

- Drawbacks of homogeneous lump-sum payments
 - Patient selection, discrimination, lower quality (Ellis (JHE, 1998), Newhouse (JEL, 1996))
- Mixed payments
 - Combining lump-sum and cost-reimbursement can improve social welfare (Pope (JHE, 1990), Keeler (JHE, 1990), Goodall (JHE, 1990), Ma (JEMS, 1994, 1998), Laffont and Tirole (MIT, 1993), Chalkley and Malcomson (Handbook of HE, 2000))
 - However implementation of such a system is not easy: characterization and estimation of the optimal proportions of the lump-sum and actual costs

Issue of hospital heterogeneity (2)

- Recently
 - we have proposed a payment system that creates incentives to increase hospital efficiency when hospitals are heterogeneous, without reducing quality of care → Dormont & Milcent (HE, 2004 ; JEMS 2005)
 - the implementation of our method of payment requires information about costs per stay for each regulated hospital
- Here, we investigate the possibility of implementing such a method of payment by combining our two sources of information
 - A hospital sub-sample with costs per stay
 - An exhaustive database about length of stay, diagnoses and procedures implemented.

Feasible heterogeneous payments: Definition

$$C_{iht} = \gamma + D_{iht}\alpha + X'_{iht}\beta + \eta_h + \zeta_{iht}$$

$$P_{iht}^{rule} = \hat{\gamma} + E(D_{iht})\hat{\alpha} + X'_{iht}\hat{\beta} + \hat{\eta}_h$$

With

$$D_{ih} = X'_{ih}b + \delta_h + \mu_{ih}$$

$$\delta_h = \delta + \theta_h + \lambda_h$$

Therefore,

$$P_{ih}^{ex\ post} = \hat{\gamma} + D_{ih}^{eff}\hat{\alpha} + X'_{ih}\hat{\beta} \quad \text{with} \quad D_{ih}^{eff} = X'_{ih}b + \delta_h - \lambda_h$$

Feasible heterogeneous payments: Estimation

- First step
 - Estimation of the LOS equation

$$D_{ih} = X'_{ih}b + \delta_h + \mu_{ih}$$

- With δ_h specified as fixed effects:

- Second step: SCF approach

$$\delta_h = \delta + \theta_h + \lambda_h \text{ with } \theta_h \sim N(0, \sigma_\theta^2), \text{ and } \lambda_h = |\ell_h|, \ell_h \sim N(0, \sigma_\ell^2)$$

Results: budget savings

DRG		370	371	372	373
(1)	M1 Average cost computed using OFS database <i>(Using the estimate of $E(C/D, X)$)</i>	7 483	6 764	4 428	3 983
(2)	Heterogenous Payments P Average Potential budget savings (= Relative difference with respect to M1)	6471 - 13.5%	6477 - 4.2 %	4134 - 6.6 %	3 852 - 3.3 %

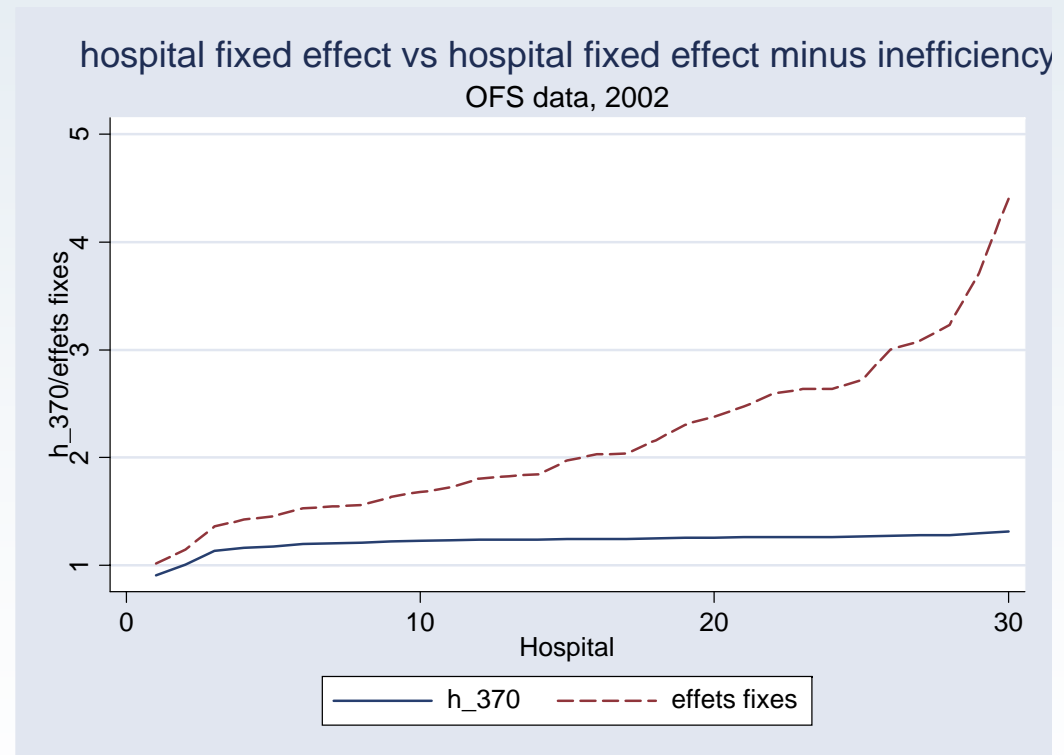
Swiss-DRG database: 7 hospitals, 12 123 stays, years 1999-2001

OFS database: 80 hospitals, 29 495 stays, year 2002 , OFS database / $N_i \geq 20$: 77 hospitals, 29 128 stays.

- Combining our two databases, we define a payment system which
 - Allows for hospital and patient heterogeneity
 - Provides incentives to reduce costs: sizable budget savings
- Feasible with the information that is currently available in most countries
- Could be implemented at the present time in most countries

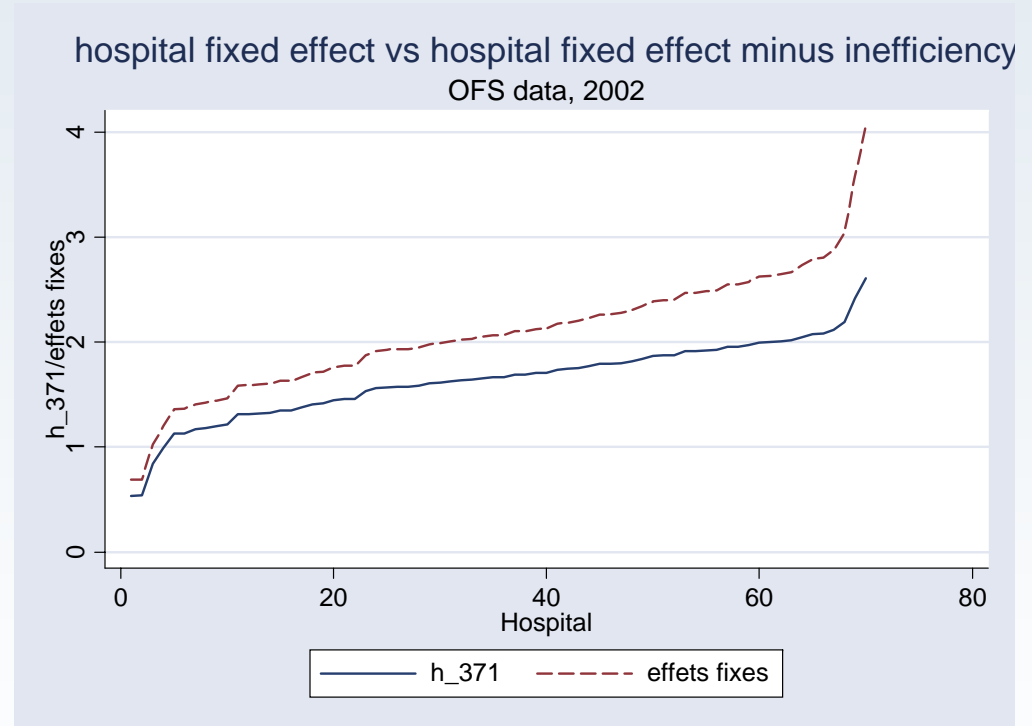
Results: Efficiency in LOS equation DRG 370

- Hospital heterogeneity is very large for DRG 370 (C-sections with complications):
 - From 1 day to 4.5 days
 - (average LOS=8.5 days)
- This heterogeneity is almost entirely due to inefficiency



Results: Efficiency in LOS equation DRG 371

- The variability is comparable for DRG 371 (C-sections without complications):
 - From 0.5 day to 4 days (average LOS=7.9 days)
- Inefficiency has a small impact on hospital heterogeneity: the two curves are almost parallel



Results: Efficiency in LOS equation vaginal deliveries

Similar results are observed

Conclusions 2 (continued)

- Heterogeneous payments generally not feasible to a large scale
- Our payment → great advantage of taking unobservable hospital heterogeneity into account as regards LOS, which allows us to reimburse high-quality care
- Our payment rule takes patient characteristics into account → limiting incentives for patient selection
- Use of the exhaustive database → possible to observe a large number of hospitals and to identify inefficiency by a SCF estimation
- Feasible with the information that is currently available in most countries: could be implemented at the present time