

Supplementary Materials for

Hospital efficiency: how to spend less maintaining quality?

Paolo Campanella, Elena Azzolini, Alessio Izzi, Ferruccio Pelone, Concetta De Meo, Daniele La Milia, Maria Lucia Specchia and Walter Ricciardi

**Corresponding author:*

Paolo Campanella, Dipartimento di Sanità Pubblica, Università Cattolica del Sacro Cuore, Largo F. Vito 1, 00168 Rome, Italy. E-mail: paolo.campanella@icloud.com.

Published on

Ann Ist Super Sanità 2017 Vol. 53, No. 1

DOI: 10.4415/ANN_17_01_10

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Additional File 1

Descriptive information of the results of the bootstrap analysis of the DEA model.

DMU	Efficiency scores (original model)	Efficiency scores (bias corrected)	CI lower bound	CI upper bound	Bootstrap bias estimate	Bootstrap var. estimate
(1)	1.00000	0.88692	0.82090	0.98680	0.12750	0.00246
(2)	1.00000	0.88403	0.82670	0.98606	0.13119	0.00228
(3)	1.00000	0.90272	0.85650	0.98416	0.10776	0.00129
(4)	0.97449	0.89107	0.81900	0.96704	0.09607	0.00218
(5)	0.93547	0.85296	0.79337	0.92875	0.10341	0.00236
(6)	0.92226	0.88420	0.83377	0.91554	0.04668	0.00073
(7)	0.91615	0.86842	0.82788	0.90520	0.05999	0.00066
(8)	0.90796	0.86721	0.82879	0.89886	0.05175	0.00061
(9)	0.88635	0.81325	0.74999	0.87918	0.10142	0.00250
(10)	0.87569	0.81761	0.75985	0.86781	0.08112	0.00179
(11)	0.82732	0.77710	0.73258	0.81740	0.07811	0.00125
(12)	0.81703	0.77347	0.73044	0.80811	0.06892	0.00109
(13)	0.81553	0.77604	0.73228	0.80973	0.06239	0.00108
(14)	0.80205	0.75430	0.70438	0.79590	0.07893	0.00179
(15)	0.80062	0.73927	0.68398	0.79078	0.10366	0.00240
(16)	0.80009	0.74231	0.67951	0.79538	0.09728	0.00314
(17)	0.79169	0.74153	0.70653	0.77908	0.08544	0.00108
(18)	0.78922	0.75432	0.71958	0.78067	0.05862	0.00073
(19)	0.78539	0.70736	0.64988	0.77852	0.14046	0.00450
(20)	0.78444	0.75257	0.71883	0.77837	0.05397	0.00076
(21)	0.77780	0.74714	0.70882	0.77156	0.05277	0.00087
(22)	0.77625	0.71370	0.65464	0.77211	0.11289	0.00385
(23)	0.76788	0.69379	0.63986	0.75661	0.13906	0.00422
(24)	0.75760	0.70805	0.66285	0.74907	0.09238	0.00196
(25)	0.75583	0.69243	0.64399	0.74985	0.12114	0.00298
(26)	0.74977	0.70076	0.65251	0.74007	0.09328	0.00219
(27)	0.74898	0.71377	0.67166	0.74298	0.06586	0.00128
(28)	0.74871	0.69492	0.64196	0.74243	0.10339	0.00301
(29)	0.74739	0.71487	0.67222	0.74258	0.06087	0.00128
(30)	0.74719	0.71165	0.66986	0.74185	0.06684	0.00130
(31)	0.74303	0.69457	0.65879	0.73426	0.09390	0.00154
(32)	0.73798	0.68598	0.64291	0.72674	0.10271	0.00197
(33)	0.73588	0.67302	0.62500	0.72631	0.12692	0.00352
(34)	0.73475	0.70614	0.67667	0.72861	0.05513	0.00065
(35)	0.73101	0.68622	0.64234	0.72303	0.08929	0.00186
(36)	0.72505	0.69143	0.65900	0.71845	0.06705	0.00099
(37)	0.72122	0.64944	0.59653	0.71545	0.15325	0.00569
(38)	0.72114	0.68401	0.63984	0.71394	0.07528	0.00170
(39)	0.71267	0.67866	0.64684	0.70671	0.07033	0.00098
(40)	0.69754	0.65336	0.61047	0.69182	0.09694	0.00254
(41)	0.68941	0.66016	0.62606	0.68517	0.06427	0.00118
(42)	0.67370	0.64136	0.60186	0.66700	0.07486	0.00174
(43)	0.66073	0.61281	0.56195	0.65697	0.11836	0.00457
(44)	0.65923	0.62281	0.59328	0.65041	0.08871	0.00141
(45)	0.65114	0.61827	0.58041	0.64647	0.08165	0.00187
(46)	0.64439	0.62259	0.59505	0.64071	0.05434	0.00089
(47)	0.63590	0.60389	0.57624	0.63114	0.08336	0.00140
(48)	0.62933	0.59491	0.56645	0.62409	0.09193	0.00158
(49)	0.59196	0.56543	0.54053	0.58530	0.07926	0.00130
(50)	0.58619	0.54815	0.51168	0.58106	0.11838	0.00377

Additional File 2A

Efficiency score, Case mix Index and Entropy Index vaues of Decision Making Units included in the DEA model

DMU	Region	Efficiency Score	Z ₁	Z ₂
(1)	Sicily	100.00%	0.87	2.14
(2)	Sicily	100.00%	0.82	2.18
(3)	Sicily	100.00%	1.00	2.27
(4)	Lombardy	97.45%	0.86	2.23
(5)	Sicily	93.55%	0.98	2.33
(6)	Umbria	92.23%	1.13	2.39
(7)	Umbria	91.61%	1.05	2.38
(8)	Calabria	90.80%	0.89	2.26
(9)	Lombardy	88.64%	0.89	2.23
(10)	Sicily	87.57%	1.00	2.29
(11)	Campania	82.73%	1.05	2.30
(12)	Sardinia	81.70%	1.10	2.31
(13)	Marche	81.55%	1.07	2.25
(14)	Lombardy	80.21%	1.07	2.42
(15)	Lombardy	80.06%	0.93	2.30
(16)	Lombardy	80.01%	1.01	2.35
(17)	Campania	79.17%	1.00	2.32
(18)	Lombardy	78.92%	1.21	2.30
(19)	Lombardy	78.54%	0.83	2.27
(20)	Campania	78.44%	1.04	2.33
(21)	Lombardy	77.78%	0.90	2.17
(22)	Lombardy	77.62%	1.03	2.31
(23)	Emilia Romagna	76.79%	1.06	2.32
(24)	Friuli Venezia Giulia	75.76%	1.02	2.31
(25)	Calabria	75.58%	1.08	2.30
(26)	Lombardy	74.98%	0.82	2.24
(27)	Piedmont	74.90%	1.22	2.34
(28)	Lombardy	74.87%	1.03	2.33
(29)	Lombardy	74.74%	1.04	2.32
(30)	Lombardy	74.72%	0.95	2.28
(31)	Piedmont	74.30%	1.33	2.24
(32)	Tuscany	73.80%	0.97	2.20
(33)	Lombardy	73.59%	0.94	2.25
(34)	Sicily	73.47%	0.87	2.20
(35)	Lombardy	73.10%	1.02	2.27
(36)	Calabria	72.50%	0.94	2.26
(37)	Basilicata	72.12%	1.11	2.33
(38)	Lombardy	72.11%	1.12	2.28
(39)	Lombardy	71.27%	0.98	2.30
(40)	Piedmont	69.75%	1.21	2.34
(41)	Campania	68.94%	1.39	2.03
(42)	Lombardy	67.37%	1.21	2.30
(43)	Lombardy	66.07%	0.94	2.26
(44)	Lazio	65.92%	1.12	2.30
(45)	Lombardy	65.11%	0.98	2.23
(46)	Lazio	64.44%	1.07	2.30
(47)	Lazio	63.59%	1.32	2.26
(48)	Campania	62.93%	1.12	2.21
(49)	Lombardy	59.20%	0.91	2.25
(50)	Lombardy	58.62%	1.29	2.35

Variable	Code	Mean	Std. Deviation	Min.	Max.
Case Mix Index (2010)	Contextual (Z ₁)	1.036	0.135	0.820	1.390
Entropy Index (2010)	Contextual (Z ₂)	2.279	0.066	2.030	2.420

Additional File 2B

Regional variables considered in the Tobit Regression model.

Region	Geolocation	Special Statute	Realignment Plan	(Z ₃)	(Z ₄)	(Z ₅)	(Z ₆)	(Z ₇)	(Z ₈)	(Z ₉)
Basilicata	South & Islands	No	No	16.50	0.31	6.00	149.40	10.54	12.31	€ 2'695
Calabria	South & Islands	No	Yes	18.70	0.25	9.50	131.09	10.62	13.01	€ 2'443
Campania	South & Islands	No	Yes	13.90	0.24	7.20	97.60	10.80	12.69	€ 2'659
Emilia Romagna	North	No	No	14.70	0.18	4.60	168.62	5.90	7.80	€ 2'969
Friuli Venezia Giulia	North	Yes	No	18.20	0.15	5.60	186.79	6.90	9.43	€ 3'736
Lazio	Center	No	Yes	13.50	0.22	4.20	141.85	6.82	8.69	€ 2'603
Lombardy	South & Islands	No	No	13.40	0.22	4.10	141.48	5.44	6.80	€ 2'865
Marche	Center	No	No	16.40	0.08	5.10	168.74	7.02	8.66	€ 3'063
Piedmont	North	No	Yes	11.60	0.17	3.90	178.03	6.83	8.57	€ 2'747
Sardinia	South & Islands	Yes	No	11.40	0.14	6.60	156.67	9.98	11.66	€ 2'646
Sicily	South & Islands	Yes	Yes	15.60	0.34	6.90	121.22	10.43	12.44	€ 2'652
Tuscany	Center	No	No	14.30	0.13	3.80	183.47	6.72	8.40	€ 2'911
Umbria	Center	No	No	13.60	0.12	6.30	179.64	7.70	9.37	€ 4'123

Contextual (Z₃): Potentially avoidable hospital discharge for cardiac procedures without Heart Failure rate (per 1,000 residents age 65 and over).

Contextual (Z₄): Potentially avoidable hospital discharges for long-term complications of diabetes mellitus rate (per 1,000 residents age 18 and over).

Contextual (Z₅): Potentially avoidable hospital discharges for COPD rate (per 1,000 residents aged 65 years and over).

Contextual (Z₆): Aging Index (Males and females).

Contextual (Z₇): Percentage of public health care expenditure on GDP.

Contextual (Z₈): Percentage of total health care expenditure on GDP.

Contextual (Z₉): Regional average DRG reimbursement. (In EU Euros at 2010).