
Health Expenditure and Demography in Italian Regions

Are resources that Italian Regions use for their Health Care Systems proportionate in a relative sense, that means in the light of the average relationship that can be observed in Italy between health consumption at regional level and the most important expenditure driver of health care costs that is regional population composition by age? This work tries to provide a first statement.



This work presents a benchmarking between regional Health Care Systems in Italy. The analysis adopts a demand side point of view¹, in the sense that it tries to explain dynamics of real per-capita public health expenditure on the basis of the pure composition of population by age. Following the series of benchmarking based on per-capita expenditure profiles by age and sex developed by Reforming last years², this time a different approach is implemented: instead of taking expenditure per-capita profiles by age/sex already estimated by other authors on data gathered at hospitals level, a panel econometric model is set up linking regional real per-capita health expenditures³ to the incidence of relevant age

brackets on regional populations over the period 2002-2016⁴.

¹ Several benchmarking exercises adopt a mix of demand and supply drivers. If this comprehensive approach is useful when the aim is medium-longrun projecting of expenditure at national level, it is quite controversial when exploring relative capabilities of different expenditure units, especially when they belong to a small and homogenous country like Italy. For example, the availability of technology, devices, and medical infrastructures in general, can have multiple effects and also of different signs: it can explain parts of expenditure (working as a positive driver), but one may argue that also the absence of adequate infrastructures can exert positive influence on expenditure, postponing the provision of cares so exacerbating problems, or obliging to make use of old and less effective techniques, or forcing to buy services from other Regions or even abroad (the so called 'mobility of patients').

² See for example on the website <http://www.reforming.it/articoli/benchmarking-ssr-sicilia#.WtSrcEbQMn0> or <http://www.reforming.it/articoli/benchmarking-ssr-trentino-alto-adige#.WtSrh0bQMn0> and other works cited at the same pages.

³ Source: State General Accounting (2017), "Health Expenditure Monitoring. Report n. 4".

⁴ Source: Istat, online dataset.

Regressions use also three sets of control variables: 1) yearly dummies to take into account annual events influencing all Regions at the same time, 2) Region-specific dummies to consider structural differences between Regions affecting their capabilities to provide health care in efficient way, and 3) further time-dummies (on top of the yearly ones) exerting a specific effect in the years when the economic crisis was at the peak (the so called 'double-dip', 2008-2009 and 2012-2014). Using Region-specific dummies give the model the same structure as a panel fixed-effects model, providing the same results as well. Region-specific dummies can be used to capture the level of inefficiency (if negative) or efficiency (if positive) in managing regional Health Care Systems.

Table 1 – Regression output

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. reg pcRealHExpRGS demo* DOUBLEDIP i.Regio i.YEAR, robust noconst
note: 2014.YEAR omitted because of collinearity
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Linear regression

	Number of obs	=	300
	F(36, 264)	=	17365.22
	Prob > F	=	0.0000
	R-squared	=	0.9991
	Root MSE	=	47.604

pcRealHExp-S	Robust		t	P> t	[95% Conf. Interval]	
	Coef.	Std. Err.			[95% Conf. Interval]	[95% Conf. Interval]
demo_71_over	5198.332	768.8264	6.76	0.000	3684.52	6712.144
demo_55_70	2056.452	446.843	4.61	0.000	1178.592	2934.313
demo_0_1_2	11228.7	2383.269	4.71	0.000	6536.069	15921.34
DOUBLEDIP	-77.45806	23.00701	-3.37	0.001	-122.7586	-32.15747
Regio						
BAS	.3211106	18.43316	0.02	0.986	-35.9736	36.61583
CAL	13.31894	23.05357	0.58	0.564	-32.07331	58.7112
CAN	139.2812	40.6306	3.43	0.001	59.2799	219.2824
EMR	8.617079	21.44049	0.40	0.688	-33.59905	50.83321
FVG	-4.327319	24.15418	-0.18	0.858	-51.88666	43.23203
LAZ	203.7275	34.20531	5.96	0.000	136.3776	271.0774
LIG	-58.95429	36.46916	-1.62	0.107	-130.7617	12.85313
LOM	33.08348	26.25942	1.26	0.209	-18.62107	84.78804
MAR	-102.7569	19.93733	-5.15	0.000	-142.0134	-63.50053
MOL	188.6682	29.70173	6.35	0.000	130.1857	247.1506
PIE	-25.01636	19.46924	-1.28	0.200	-63.3511	13.31839
PUG	42.29585	26.80281	1.58	0.116	-10.47863	95.07034
SAR	161.333	24.04732	6.71	0.000	113.9841	208.6819
SIC	27.62551	27.89377	0.99	0.323	-27.29705	82.54808
TAA	368.5983	31.70903	11.62	0.000	306.1635	431.0331
TOS	-44.18493	21.50079	-2.06	0.041	-86.51979	-1.850082
UMB	-82.44817	22.04382	-3.74	0.000	-125.8522	-39.0441
VDA	217.0489	24.78277	8.76	0.000	168.2518	265.8459
VEN	21.4622	22.45598	0.96	0.340	-22.75342	65.67781
YEAR						
2003	4.652851	16.0218	0.29	0.772	-26.89393	36.19963
2004	68.68189	19.82665	3.46	0.001	29.64341	107.7204
2005	121.0595	20.01526	6.05	0.000	81.64965	160.4694
2006	103.1133	18.81641	5.48	0.000	66.06401	140.1627
2007	120.1073	16.95871	7.08	0.000	86.71575	153.4988
2008	186.1753	16.63633	11.19	0.000	153.4185	218.9321
2009	198.2919	16.21671	12.23	0.000	166.3614	230.2224
2010	97.96283	17.65871	5.55	0.000	63.193	132.7327
2011	36.8075	19.83877	1.86	0.065	-2.254842	75.86984
2012	60.98498	13.67633	4.46	0.000	34.05642	87.91355
2013	18.70338	14.12182	1.32	0.187	-9.102357	46.50911
2014	0 (omitted)					
2015	-85.34653	24.51558	-3.48	0.001	-133.6175	-37.07558
2016	-65.64906	25.061	-2.62	0.009	-114.9939	-16.30419

Source: Reforming elab. on ISTAT and State General Accounting

Different specifications of the model (see Table 1) proved that three groups of ages have the highest relevance: proximity to birth (0-2 years), advanced maturity (55-70 years) and old age (over 70 years old). This appears quite coherent with what economic literature (theoretical and empirical) suggests about relative consumption of health care provisions across ages. Coefficients of these regressors come out with expected sign and expected relative magnitude and are all statistically significant.

Also yearly dummies, complemented by the ‘double-dip’ dummy, proved significant across different specifications of the model. Yearly dummies result almost all significant and also with a quite plausible dynamics over time, becoming less and less positive as the crisis approaches and turning into negative after 2014. The ‘double-dip’ dummy comes out significant and with the expected negative sign as well⁵.

As far as Region-specific effects are concerned, a result is surely worth to be mentioned. Across a wide range of specifications of the model, only few regional fixed effects (‘FES’) result significantly different from zero. Most of them cannot be claimed significantly different from zero, implying - at least at a glance - that there are not so deep structural differences in the absorption of resources after taking into account population composition by age.

Table 2 – Significance of explanatory variables and controls⁶

estimates table, star(.05 .01 .001)

Variable	active
demo_71_over	5198.3322***
demo_55_70	2056.4523***
demo_0_1_2	11228.704***
DOUBLEDDIP	-77.458059***
Regio	
BAS	.32111064
CAL	13.318944
CAM	139.28117***
EMR	8.6170794
FVG	-4.3273186
LAZ	203.72749***
LIG	-58.954294
LOM	33.083483
MAR	-102.75695***
MOL	188.66815***
PIE	-25.016356
PUG	42.295853
SAR	161.333***
SIC	27.625515
TAA	368.59832***
TOS	-44.184934*
UMB	-82.448172***
VDA	217.04885***
VEN	21.462198
YEAR	
2003	4.6528509
2004	68.681894***
2005	121.05951***
2006	103.11334***
2007	120.10729***
2008	186.1753***
2009	198.2919***
2010	97.962834***
2011	36.807501
2012	60.984984***
2013	18.703376
2014	(omitted)
2015	-85.346526***
2016	-65.649063**

legend: * p<.05; ** p<.01; *** p<.001

Source: Reforming elab. on ISTAT and State General Accounting

Table 2 shows the 9 Italian Regions that, across several regressions with different specifications of the model, constantly reveal fixed effects significantly different from zero. Other Regions never or very rarely exhibit significant fixed effects. Moreover, while ‘FES’ for these 9 Regions come out with expected signs and maintain it across all possible specifications, for the rest of the Regions the sign of the relationship often change, depending on the age brackets used as regressors and the specification of the dummy dedicated to the crisis.

Fixed effects are highly significant (***) for: Campania, Lazio, Marche, Molise, Sardegna, Trentino Alto Adige, Umbria and Valle d’Aosta. For Toscana the ‘FE’ results significant but to a much lesser extent (*).

For Campania, Lazio, Molise, Sardegna, Trentino Alto Adige and Valle d’Aosta ‘FES’ reveal the presence of over-expenditures with respect to the standard level ‘justified’ by regressors (the sign of ‘FES’ is positive). For Marche, Toscana and Umbria ‘FES’ reveal the presence of under-expenditures with respect to the standard level ‘justified’ by regressors (the sign of ‘FES’ is negative).

⁵ Also other ways of considering the impact of the crisis proved effective and significant, as for example a ‘pre-post’ dummy counting 0 till 2007 and then assuming the value 1 after the start of the crisis (from 2008 on).

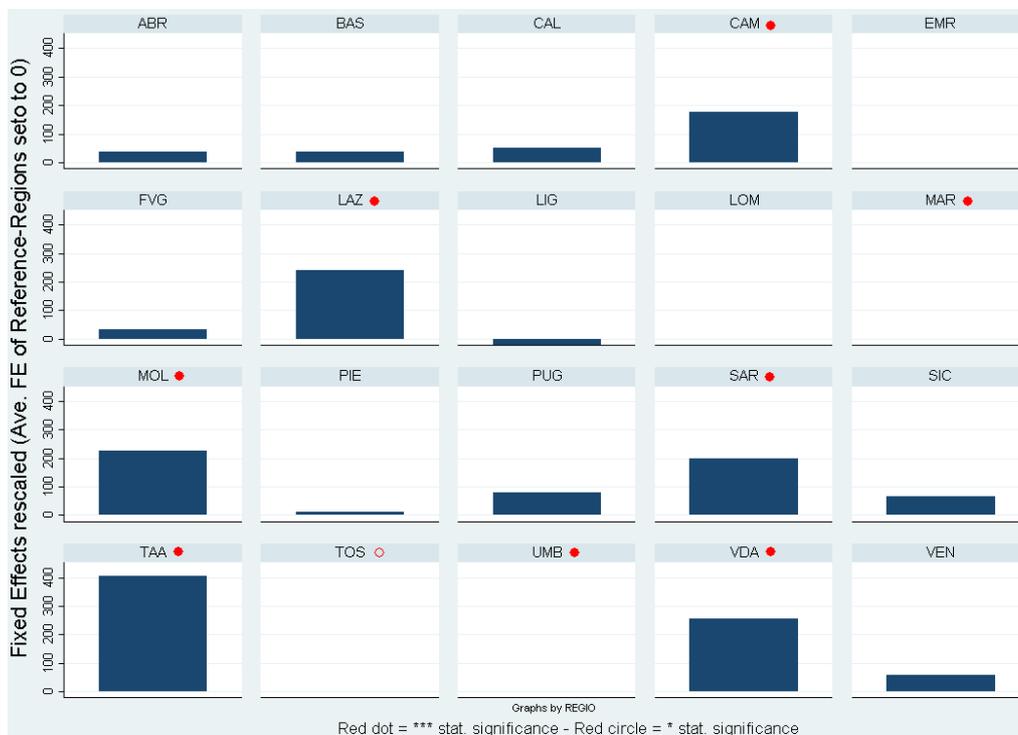
⁶ For the sake of transparency, all files (.do, .dat, .xlsx) are available on www.reforming.it.

Graph 2 - Fixed Effects (2002-Euro); FE_{Abruzzo} set to zero



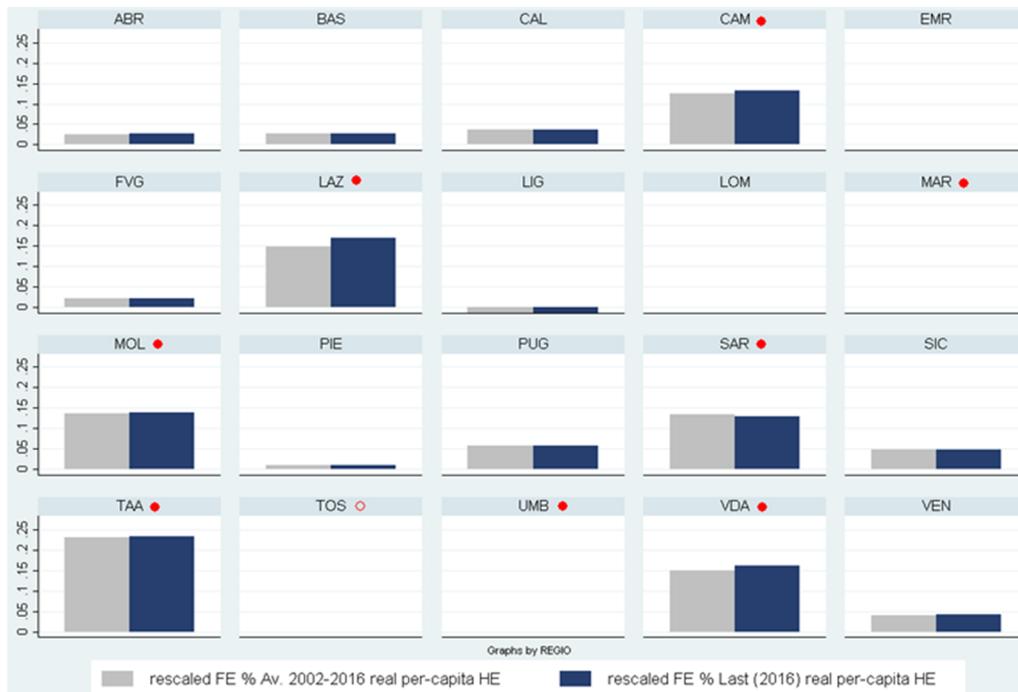
Source: Reforming elab. on ISTAT and State General Accounting

Graph 3 - Fixed Effects rescaled (2002-Euro); average 'FE' of reference-Regions set to zero



Source: Reforming elab. on ISTAT and State General Accounting

Graph 4 - Fixed Effects rescaled and expressed in % of per-capita HC expenditure

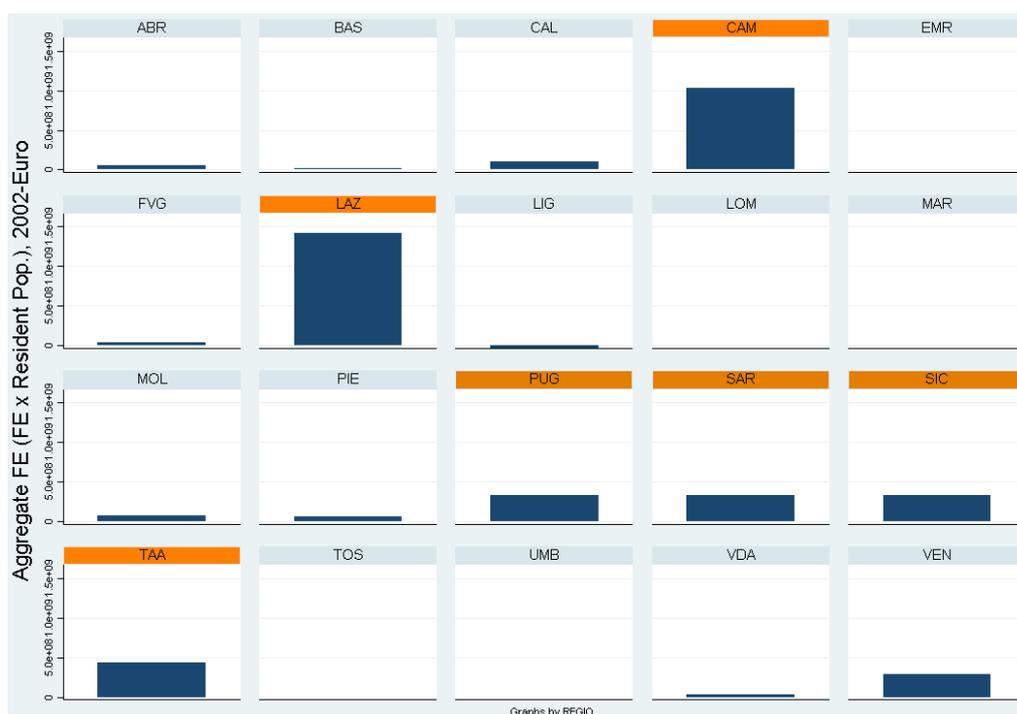


Source: Reforming elab. on ISTAT and State General Accounting

To complete analysis of estimation results, *Graph 4* describes rescaled 'FEs' as percentages of the average real per-capita health expenditure over the horizon 2002-2016, as well as percentages of the real per-capita health expenditure of 2016 (last year covered in the analysis). Highest incidences are shown by Trentino Alto Adige, Lazio, Valle d'Aosta, Molise, Sardegna and Campania, all with double-figure percentages. Puglia and Sicilia have incidences beyond 5 per cent. Other Regions stay slightly below 5 per cent in the case of Veneto, Calabria, Basilicata, Abruzzo, and below 2,5 per cent in the case of Friuli Venezia Giulia and Piemonte. Liguria has a negative 'FE', almost close to zero (it is the oldest Region in Italy, with the highest incidence of elders).

If, moving away from a per-capita perspective, numbers are multiplied by regional residents, it is possible to provide an evaluation of yearly aggregate costs of inefficiencies. *Graph 5* and *Table 3* give this information. At a glance from *Graph 5*, it seems that relevant aggregate 'FEs' emerge above all in two Regions: Lazio and Campania. Despite its relatively small geographical dimension, the third heaviest 'FE' belongs to Trentino Alto Adige. Then, there is a third group of four Regions with smaller nonetheless still evident overspendings: Puglia, Sicilia, Sardegna and Veneto. Remaining Regions show less problematic aggregate 'FEs', amounting to few tens of millions of Euro each. Liguria continues showing a negative value close to zero.

Graph 5 - Overspending at regionale level ('FEs' x resident population, 2002-Euro)



Source: Reforming elab. on ISTAT and State General Accounting

Table 3 – Summing-up of yearly regional contributions to HC Overspending (2002-Euro)

Regions	Reference-Regio	Aggregate FE or Overspending (2002-Euro)
ABR		49,794,511
BAS		21,719,487
CAL		100,200,000
CAM		1,035,000,000
EMR	yes	0
FVG		40,557,358
LAZ		1,421,000,000
LIG		-33,646,292
LOM	yes	0
MAR	yes	0
MOL		70,582,395
PIE		55,147,954
PUG		325,500,000
SAR		329,800,000
SIC		330,700,000
TAA		430,100,000
TOS	yes	0
UMB	yes	0
VDA		32,416,276
VEN		290,000,000
Total Overspending		4,498,871,689
(LAZ + CAMP) / TOT		54.6%
(LAZ + CAMP + TAA) / TOT		64.2%
Total Overspending / National HE 2016		5.12%

Source: Reforming elab.

If Lazio realigned to the average performance of the best five Regions (reference-Regions selected by Ministry of Health), it would be possible to free approximately 1,4 billion Euro per year. In the case of Campania, the margin of efficiency would amount to slightly above 1,0 billion Euro. As for the other Regions: Trentino Alto Adige could save approximately 0,4 billion Euro per year, Sicilia, Sardegna and Puglia slightly above 0,3 billion, Veneto 290 million, Calabria more than 100 million, Molise slightly above 70 million, Piemonte 55 million, Abruzzo almost 50 million, Friuli Venezia Giulia slightly above 40 million, Valle d'Aosta approximately 32 million Euro per year.

In the total aggregate, the amount of resources that could be, year by year, better spent is slightly below 4,5 billion Euro, large part of which arising from Lazio and Campania: more than 54 per cent, becoming more than 64 per cent if we include overspending by Trentino Alto Adige. With respect to the national health expenditure in 2016 (expressed in 2002 Euro) this means a cost inefficiency of approximately 5 per cent. This incidence could have also been smaller (under 5 p.p.) if we had made the choice of setting directly to zero those 'FES' not statistically different from zero in the results of the initial panel estimation.

It is possible to conclude that, despite the troubles of the crisis, Italian regional Health Care Systems proved capable of functioning on fair efficient regimes, taken into account the different composition of population by age brackets. Aggregate inefficiencies are limited to 5,0 per cent of total national expenditure, a weakness that can be surely improved but does not raise any immediate big alert per se. Nonetheless, this rather positive judgement should not hide the fact that current inefficiencies are concentrated in very few Regions (Lazio and Campania in particular), and that they have to be fixed as soon as possible, also in the light of future challenges that aging and costs of technological discoveries will constitute for the longrun sustainability of health care systems (not only for the Italian of course).

From the point of view of the absorption of resources, here we traced a quick but clear picture of the state-of-arts. But this is only half of the story. Of course, also resources theoretically proportionate to the final goal can be spent with different capabilities, and final services for citizens can be offered with different levels of quality and effectiveness, crucially depending also on the quality of the devices and infrastructure endowments. This latter is, indeed, the dimensions along which regional gaps are most relevant and urging policy solutions: the quality and the effectiveness of Euros spent for health care purposes.

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