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ORIGINAL PAPER

The residential healthcare for the elderly in Italy: some considerations for post-COVID-19 policies

Alessandra Cepparulo[1] · **Luisa Giuriato**[1]

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Abstract

In Italy, the COVID-19 pandemic and the death of many elderly people have put in evidence the uneven territorial distribution of nursing homes, which have amplified the spread and severity of the pandemic. By applying a pooled OLS model to the Italian regions, over the 2010–18 period, we investigate the demand factors, market forces and institutional drivers of the spatial distribution of residential healthcare for the elderly. Using a fine-grained approach that considers specific regional and age-related elements and the market environment, which can reduce or increase the pressure on regional governments to provide formal assistance, we find that the financial resources and the availability of unemployed women as potential caregivers explain the distribution of expenditure better than the health needs of the elderly. As a result, the expenditure is concentrated in richer and more financially autonomous regions and it is not congruent with the distribution of chronicity, health and frailty factors or income among the elderly. These critical issues of the care services for frail elderly people, related to a highly decentralized governance and resulting in fragmented, market-driven provision, could be attacked only by a national reform.

Keywords Long-term care facilities · Nursing homes · Elderly care · Regional divergence · Healthcare decentralization · Informal care

JEL Classification J14 · H51 · H75 · I18 · R50

Introduction

The territorial distribution of nursing homes —or long-term care facilities (LTCF)[1]—in Italy exhibits a gradient moving from the North to the South of the country with large differences within the same geographic areas. Central–Southern Regions have on average less than five beds for every 100 dependent people aged over 75, while facilities in the Northern Regions reach 25 beds [1]. This peculiar spatial distribution came to the forefront during the COVID-19 pandemic, which claimed the lives of many residents in nursing homes [2–4]. Although other factors (the moment in which the virus arrives and its incidence in the territory) contribute to explain the territorial impact of the COVID-19 pandemic, the presence of nursing homes seems to be crucial to its diffusion and severity. The high risk of COVID-19 transmission in LTCF puts at stake the lives of their inpatients,[2] while also increasing the risk of spreading the virus back into the community and escalating the infection. In Italy, the distribution of COVID-19 cases and the number of beds in LTCF for patients aged over 65 show a linear, monotonically increasing and statistically significant relationship,[3] both in the first (Fig. 1a) and second wave (Fig. 1b).

✉ Luisa Giuriato
luisa.giuriato@uniroma1.it

[1] Department of Economics and Law, Sapienza-University of Rome, Via del Castro Laurenziano 9, 00161 Rome, Italy

[1] We use LTCF to indicate non-acute nursing facilities that house over-65 people with long-term care (LTC) needs. They are a subgroup of all health and social-care facilities. LTC refers to the services in support of the elderly (65 or over) with limitations in everyday activities.

[2] The concentration of the elderly in closed communities has amplified the possibility of virus replication [5]. The impact of the COVID-19 pandemic on LTCF elderly residents in Italy has been investigated by the National Health Institute [4] and in some studies [3, 6]. Italy has not extensively proceeded to collect data on the number of COVID-19 cases among LTCF residents and critical information on nursing homes (staff, ownership structure, management) are still missing or inaccurate.

[3] The relation is confirmed by the Pearson and Spearman coefficients equal to 0.918 and 0.893, respectively (both significant at 0.01), for the first wave and to 0.883 and 0.860, respectively (both significant at 0.01), for the second wave. See Liotta et al. [7].

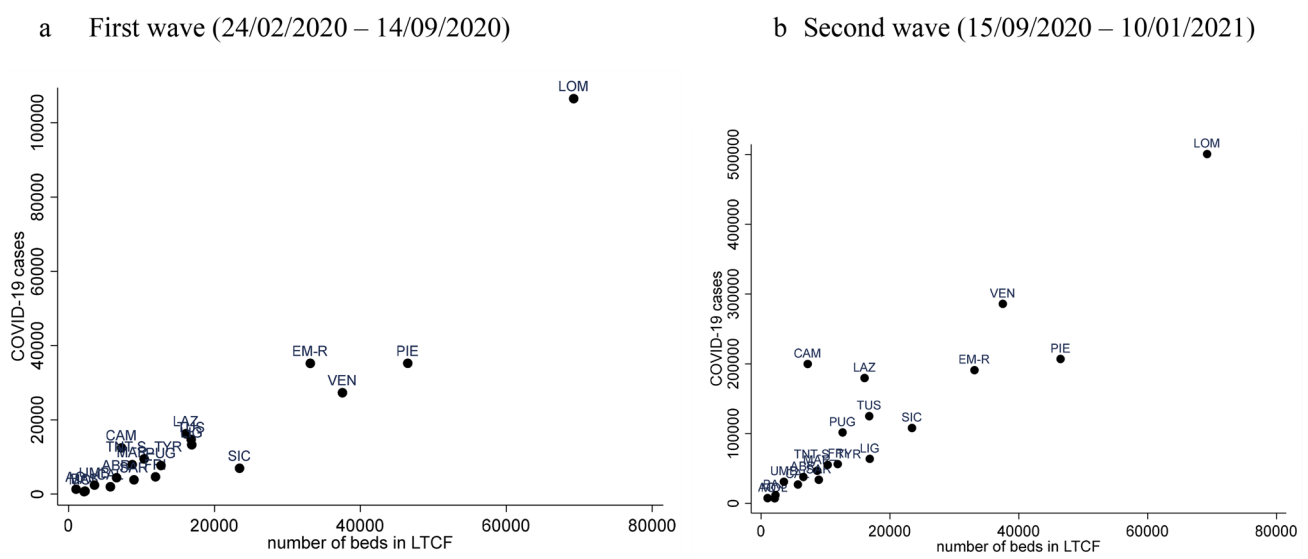

Fig. 1 Italy: Regional distribution of COVID-19 cases and number of beds in LTCF. **a** First wave (24/02/2020–14/09/2020). **b** Second wave (15/09/2020–10/01/2021). Source: own elaboration on data from the Ministry of Health (COVID-19 cases) and Ministry of the Interior (beds in LTCF)

Residential LTC is the core service for frail elderly people in Italy. It is organized and provided at sub-national level, and its healthcare component belongs to the essential services that should be guaranteed to all citizens under the current devolution framework, which safeguards equality and compensates for differences in regional fiscal capacity by means of equalization grants. However, regional preferences, different needs and health system design and management introduce heterogeneity in the levels of service provision.

Using data on regional expenditure provided by the Ministry of Health for the years 2010–18, we investigate which factors drive the spatial distribution of nursing homes and spur their concentration in some areas better than in others. By focusing on a specific line of expenditure—the regional expenditure for residential healthcare services for a specific age group (people aged over 65)—we can investigate the heterogeneity across regions in greater detail. We could not employ the number and characteristics of LTCF (number of facilities, inpatients, types and quality of services) given the poor data available.

The paper adds to the still limited empirical studies on the effect of the determinants of healthcare expenditure at regional level [8–16], while it is original for its focus on residential healthcare spending. Part of the literature points to devolution as the main driver of spatial health heterogeneity in contexts where the mechanisms for increased local accountability—competition across jurisdictions, policy innovation and diffusion, regional mobility, no bail-out expectations—jam and produce unintended effects [8, 17, 18]. However, evidence is not clear-cut, and some studies relate regional inequalities in overall health expenditure and outcomes not to decentralization, rather to differences in needs or to region-specific factors [19–22]. In our investigation, we employ both classes of potential drivers, with, in addition, a fine-grained approach focused on age-specific chronicity, health, and frailty factors and on income inequality. Besides, we try to shed light on how the allocation of resources by regional governments depends on social and market pressures to supply formal care to frail elderly people. Still, the paper provides a support to policy-makers, given the urgency to reform the elderly LTC system after the COVID-19 pandemic, which put to the forefront the fragilities of the institutionalization system for frail elderly people.[4]

The paper is structured as follows. We start by sketching the institutional background and the Italian devolution framework that is relevant for residential LTC for the elderly (Sect. 2). Then, some descriptive evidence is provided with a first analysis of the regional expenditure for residential healthcare (Sect. 3). In Sect. 4, we outline the model, the main drivers and discuss the results. A final section concludes.

[4] While institutionalization is still prevalent for dependent older adults, that for children and disabled people has been replaced by other forms of home and community care since the early 1980s.

Institutional background

Health and LTC policies are among the competences of sub-national governments in Italy. Since the 1990s, Italy has reformed its centrally financed National Health Service, which provides uniform and comprehensive healthcare funded by general taxation and has devolved greater responsibilities to regional health authorities. This has resulted in multiple governance models, with differences in the composition of public and private providers, the number and size of local health units, public hospital autonomy. In 2000, regions were also entrusted with the functions of coordinating, planning and monitoring social services.

To avoid excess differentiation in the services provided, the 2001 Constitutional Reform assigned the Central Government the responsibility of establishing national standards—i.e., fundamental principles and the basic benefit package that must be provided in all regions—for services concerning primary social and civil rights, including health and social care. Within this framework, regions are given responsibility and autonomy in the organization and management of the services at the local level. Still, the Central Government intervenes with equalization grants if regions are not able to directly fund the standard levels of essential services by means of their own taxes.

The national standards on health services quality and access,[5] together with financing guarantees, protect equity goals and reduce the risk of under-provision. To strengthen the vertical lines of control on regional public finances and service provision, the coherence between targets and their financing, and the effective levels of service are annually monitored. A yearly assessment of the level of health services provision against national standards is performed by the Ministry of Health by means of a set of indicators.[6] Besides, regions with persistent large health deficits are compelled to adopt recovery plans with structural reorganization and cost containment measures. In case the region does not draft the plan, or if a significant deviation from the targets (expressed in terms of both financial outcomes and essential services provision) persists, a Commissioner is appointed by the Central Government.

Within this framework, LTC for the elderly is emblematic of the complex web of fiscal federal relations. The Central Government sets the national standards of service and regions are responsible for the LTC health services, which include residential and semi-residential care, home and outpatient services. The residential LTC dimensions that are relevant indicators for the annual assessment are the number of beds in LTCF and the number of 'equivalent' beds, a measure that translates the number of days of residential assistance into the number of beds.[7]

Regions pay the health care fee for LTCF residents, which is determined either by the inpatient's degree of disability (only in one Region, Lombardy) or on a daily basis. The daily fee can be differentiated according to the facility's capacity to deal with more severe cases. The accommodation fees, i.e., the costs of care that are not related to health services, are usually covered by the inpatients (and their families) based on means testing (Municipalities can also contribute). However, in case of severe disability, the regional health service can entirely finance both the health and the accommodation costs.

The LTC for the elderly is completed by largely insufficient semi-residential and health home care services provided by regions, social care services provided by Municipalities, and a cash allowance—the so-called 'carer's allowance'—, in case of certified severe disability. The cash allowance—the bulk of the LTC system, worth about 10 bn euro per year—is a flat-rate benefit financed through general taxation and paid by the National Institute of Social Security. The benefit is not means-tested and, as there are no constraints on its employment, it is often spent in the irregular private care market or to purchase services within the family, especially in low-income households [23, 24].

This framework of LTC for the elderly displays several failures. There is no stepwise and assessment-based care chain [25] that connects publicly financed and regulated forms of care at home and the most intensive forms of care in residential settings, as demonstrated by the large numbers of self-sufficient elderly hosted in Italian LTCF.[8] The insufficient offer of home assistance and the absence of new forms of community assistance make institutionalization the prevailing choice for the elderly who are not self-sufficient in Italy. The only real recent change has occurred through the entry of immigrants into private care services [26]. Migrant caregivers living with non-self-sufficient elderly people are employed directly by families, often without regular contracts[9] and using public resources (the carer's allowance).

[5] For details, see www.salute.gov.it/portale/lea/dettaglioContenutiLea.jsp?lingua=italiano&id=4773&area=Lea&menu=vuoto.

[6] www.salute.gov.it/portale/lea/dettaglioContenutiLea.jsp?lingua=italiano&id=4747&area=Lea&menu=monitoraggioLea.

[7] The number of equivalent beds is the ratio of the days spent by over-65 inpatients of LTCF (as a ratio to 365) to the over-65 population.

[8] According to the last survey by ISTAT for 2016, about 78% of the over-65 residents in LTCF are not self-sufficient (only 45% in the South).

[9] Given the importance of immigrants in care services, there have been specific regularization initiatives for the many workers employed with irregular contracts [27]. There were approximately 400,000 caregivers with regular contracts in 2019, about half the estimated number of the irregular ones (ISTAT). The number of regular contracts increased during the first wave of the COVID-19 pandemics because only workers with regular documents could move due to lockdown restrictions.

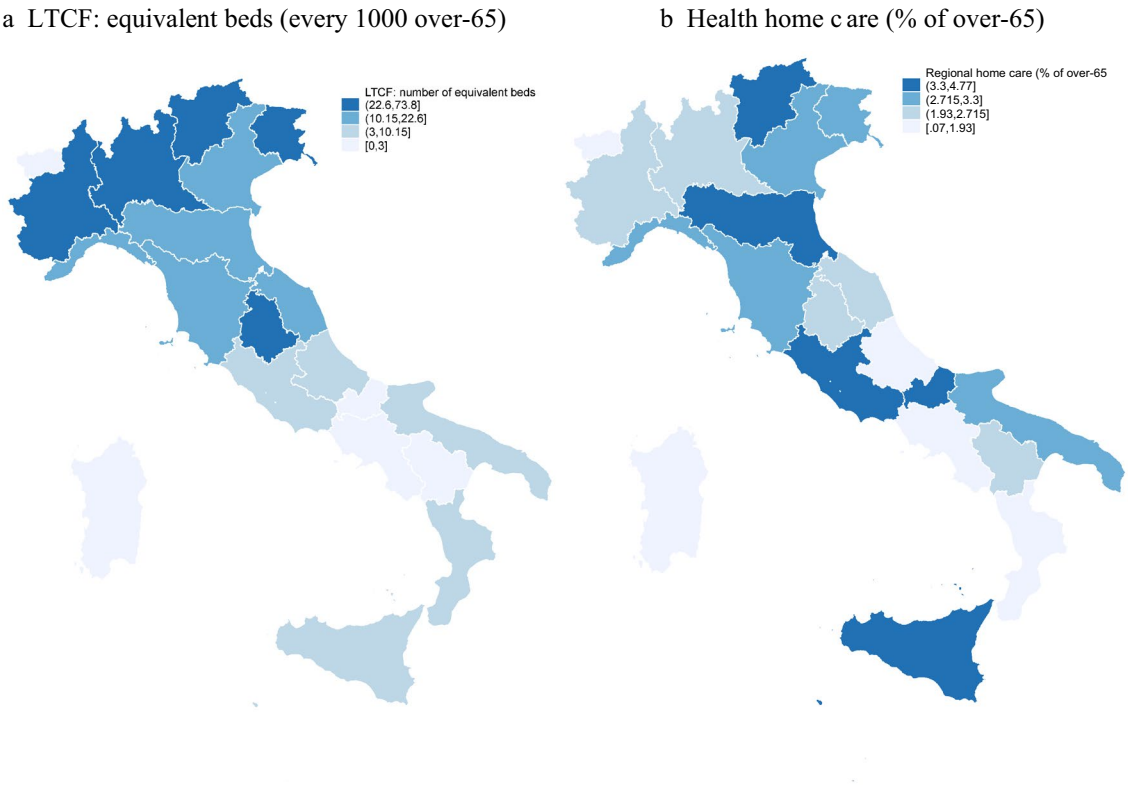

Fig. 2 LTC for the elderly financed by Regions (average 2016–18). **a** LTCF: equivalent beds (every 1000 over-65). **b** Health home care (% of over-65). Source: own elaboration on data from the Ministry of Health. The number of beds in the Aosta Valley refers to 2014–16. Data for the Trentino-Alto Adige Region refer only to Trento Autonomous Province. The number of equivalent beds is equal to the ratio of the days spent by over-65 residents in LTCF (as a ratio to 365) to the over-65 population

Previous studies have related these long-standing problems to many different factors like: fiscal consolidation policies, the fragmentation of responsibilities, the lack of agreement on cost sharing among different layers of government [28], the insufficient relevance of LTC reform for politicians, the myopic protection of the traditional welfare expenditure lines (health and pensions) by the elderly unions at the expense of LTC [24, 29], rising costs, the increase in the number of inpatients with intensive health care needs not accompanied by an adequate increase in medical and nursing staff [30].

Descriptive evidence

Italy has one of the oldest populations in the world: the dependency ratio of the elderly is 36.6% (2018) with large regional differences (from 47% in Liguria to 27.9% in Campania). Life expectancy at 65 is 19.3 for men and 22.4 for women (2019), but the COVID-19 pandemic has decreased it by 0.9 years on average (2020), while in the most-hit regions, it has dropped by far more (− 2 years in Lombardy, − 1.8 in the Aosta Valley). However, the health situation is mixed: on average, about 57 every 100 over-65 residents have more than two chronic diseases; however, in Southern Regions, their average number is 64. The average number of years that people at 65 are expected to live in good health is 7.9 for men and 6.9 for women, but in Calabria (South), it drops to 3.7 and 3.2, respectively, and in the Autonomous Province of Bolzano (North), it rises to 13 and 13.9, respectively.[10] Fragility increases for the lone elderly: the average share of over-65 residents who live alone is 29%, with peaks up to 37% in the Aosta Valley.

Residential health services, proxied by the number of equivalent beds, are highly fragmented and show a gradient moving from North to South (Fig. 2a). Regions' provision of health home care is, instead, more uniform across the country (Fig. 2b), but it covers only tiny shares of the over-65 population (2.4% on average) with low intensity (the hours dedicated to each elderly person assisted in the course of a year are 16 on average with wide regional variability [1]).

LTCF host about 289,000 inpatients aged over-65, equal to 2.1% of the relative population according to ISTAT last

[10] https://www.istat.it/it/archivio/14562.

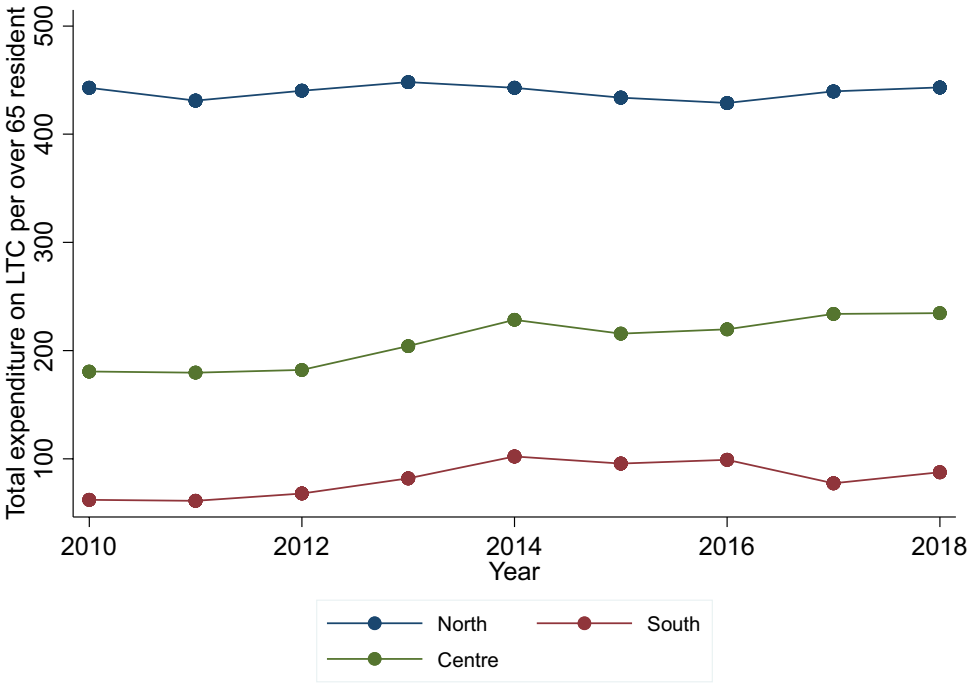

Fig. 3 Regional expenditure on LTCF per over-65 resident (average 2010–18) by geographic area. Source: own elaboration on data from the Ministry of Health

survey (2016).[11] Not all LTCF are financed by regions, as to receive public financing these structures must be authorized, accredited and respect regional standards and requirements. The number of publicly accredited facilities providing healthcare ranges from 4629 according to the National Defender of the Rights of Persons Detained or Deprived of their Liberty, to 3417, according to the Dementia Observatory of the National Institute of Health. Currently, there is no integrated quality assessment system at national level, but some regions have implemented their own indicators as a monitoring and management tool.

Given the confusion on the number of accredited LTCF and the unavailability of micro data, we employ LTCF regional spending data over the period 2010–18 provided by the Ministry of Health. These data refer to the provision of residential healthcare to the elderly, i.e., the expenditures of the regional Local Health Units for providing or buying health services for over-65 inpatients: the healthcare fees paid to accredited LTCF is the major item of expenditure (85% on average, 98% in Lombardy).[12]

Overall regional spending on LTCF has increased by 25% from 2010 to 2018 and amounts to € 3.753 billion in 2018. The expenditure per over-65 resident shows dramatic variations across the country: four euros per capita in Basilicata (South) against 1317 euros in Trento Autonomous Province (North). The per capita expenditure for residential healthcare in Northern Regions is double that of the Central Regions and more than four times higher than that of the Southern Regions (Fig. 3).

From 2010 to 2018, the per over-65 expenditure has slightly decreased in the Northern Regions, plus Abruzzo and Basilicata (South). It has increased in the South–Center, where, however, it is still much lower than in the North. Given that healthcare standards are mandated to regions and granted full financing at standard costs, differences in per capita expenditure could reflect structural factors or differences in organization and the efficient use of public resources.

Setting the average values for 2010 equal to 100 (Table 1), we compare the expenditure and the number of equivalent beds—a proxy of the patients treated—over time and among regions. All Northern Regions (except for the Aosta Valley) have higher than average levels of expenditure and LTCF beds. For most regions, both the per capita expenditure and the level of service have increased over time. Only in Piedmont, Abruzzo, Liguria, Molise and Trento, the expenditure has decreased, while the number of beds has increased, which could point to efficiency gains.

[11] Data available at http://dati.istat.it/Index.aspx?DataSetCode=DCIS_PRESIDI1.

[12] The remaining 15% of the total expenditure consists of costs incurred by the Local Health Units for residential health services they directly provide.

Table 1 Per over-65 expenditure for LCTF and number of equivalent beds (2010 and 2018): index numbers. Source: own elaboration

Region	Index number of the regional expenditure (Av 2010 = 100)		Index number of LTCF equivalent beds (Av 2010 = 100)	
	2010	2018	2010	2018
PIEDMONT	119.17	113.84	123.92	270.97
AOSTA VALLEY	24.84	65.85	0.86	11.86
LOMBARDY	176.01	204.54	236.58	290.13
TRENTO (AUT. PROV.)	516.26	460.57	361.81	673.33
VENETO	220.91	201.85	212.73	199.81
FRIULI VENEZIA GIULIA	124.50	142.25	246.42	212.58
LIGURIA	109.55	100.28	110.26	128.64
EMILIA ROMAGNA	134.13	138.75	129.64	139.59
TUSCANY	91.60	105.94	100.32	97.62
UMBRIA	83.05	84.46	57.50	227.18
MARCHE	83.51	140.80	32.52	125.91
LAZIO	33.17	47.20	34.47	55.65
ABRUZZO	64.85	39.49	38.35	52.00
MOLISE	38.39	4.52	1.92	12.77
CAMPANIA	7.65	9.23	4.66	11.86
PUGLIA	15.93	43.78	15.71	54.74
BASILICATA	5.48	1.59	11.55	10.95
CALABRIA	31.18	84.00	27.70	87.59
SICILY	19.82	30.70	5.20	41.97

Sardinia and the Bolzano Autonomous Province are not included because of missing data

A brief investigation in the efficiency of regional expenditure on residential LTC

An efficiency analysis is carried out to investigate the trend in expenditure and services provided.[13] First, we observe the relative performance of regions in 2018 via a DEA approach and then we check if there have been improvements in the last 11 years via the computation of the Malmquist index.

The efficiency of regional expenditure on residential LTC in 2018

Two are the main classes of methods used for measuring technical efficiency[14] and identifying the efficiency frontier: parametric and non-parametric, stochastic or deterministic (referring to the nature of the inefficiency).[15] The parametric approach, relying on econometric methods, assumes specific functional forms for the relationship between the inputs and the outputs, and provides a measure of "absolute efficiency", based on the theoretical/statistical identification of the best use of resources. The non-parametric approach, instead, calculates the frontier directly from the data without imposing specific functional restrictions, using mathematical programming techniques. In the last case, a measure of "relative efficiency" is provided: each decision unit's performance is compared with that of the other units. Guided by the literature on public expenditure and by the characteristics of the services under analysis, our preference goes to the non-parametric[16] approach (DEA), because it does not require any assumption about either the functional form, relating inputs to outputs, or the distribution of noise and inefficiencies.[17]

We then preferred an input-oriented approach, which minimizes inputs for given output levels, over an output-oriented model. The choice depends on the policymakers' level of control on inputs and outputs. Indeed, we consider the level of LTC expenditure as the input and the number of equivalent beds as the output.[18] As regional governments have arguably more direct control over public expenditure allocation than over the process-related output, the input-oriented approach must be preferred.

As the DEA approach is heavily dependent on the specification and definition of inputs and outputs [34], no random noise, measurement error, or outlier cases are assumed to exist in the data. Then, to avoid scaling issues, we mean normalize the data to avoid imbalances in the dataset. Outliers' detection is performed by adopting the non-parametric approach proposed by Daraio and Simar [35].

In 2018 (Fig. 4), three regions (Basilicata, Umbria, and Piedmont) and the Autonomous Province of Trento turn out to be the most efficient, lying on the frontier, while for the regions underneath the frontier, the distance from it represents the potential efficiency gain, i.e., the reduction of

[13] Due to the unavailability of data on the regional distribution of staff, no control over the quality of services can be provided.

[14] Given the lack of comparable input prices across regions, it was not easy to proceed to identify the allocative efficiency.

[15] While the deterministic approach assumes that all deviations from the frontier are explained by inefficiency, the stochastic approach assumes that those deviations are a combination of inefficiency and random shocks outside the control of the decision-maker.

[16] For the suitability of these methods for the public sector analysis, see Coelli et al. [31].

[17] The DEA approach relies only on the general axioms of the production theory: monotonicity, convexity, and homogeneity. Still, it allows for the use of different units of measure, and it does not impose any limits on the number of inputs and outputs to be considered. See Boussofiane et al. [32] and Yong –Bae and Choonjoo [33].

[18] The choice of the inputs/ outputs is guided by the availability of data, by the literature on the efficiency of public expenditure and by the need to preserve the accuracy of the efficiency measures, which decreases with the number of inputs/outputs employed.

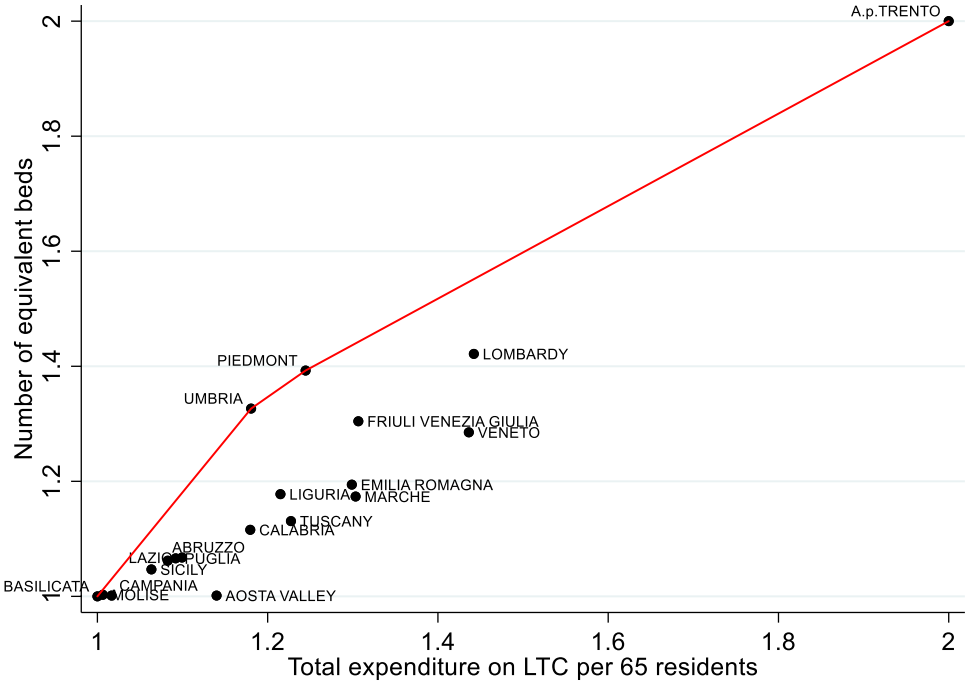

Fig. 4 The efficiency frontier of regional expenditure on residential LTC (2018). Source: own elaboration. Sardinia and the Autonomous Province of Bolzano are not included because of missing data

regional expenditure (the input) which could be possible while keeping the output unchanged.

The efficiency gain since 2010

To better assess these results and to understand if they depend on efficiency gains over time, we compute a DEA Malmquist productivity index-MPI [36, 37], a non-parametric method that measures the productivity change over years in terms of the relative performance of the units under analysis at different periods of time and technology. The productivity change can be due to either a technological change TC (i.e., a shift of the efficient boundary) or to an efficiency change TEC (i.e., a move toward the efficiency boundary). The index[19] is defined as the geometrical product of these two variables. A value greater (less) than one indicates an improvement (reduction) in productivity.

In Table 2, five regions (Puglia, Abruzzo, Aosta Valley, Sicily, Molise) show an increase in performance, i.e., a Malmquist index greater than one, attributable to technical efficiency gains that compensate for technological regress.[20] Except for the Aosta Valley, all these regions adopted a recovery plan to reduce costs and increase efficiency. The other regions show a productivity decline, which in Lombardy, Friuli-Venezia Giulia and Liguria is explained by a technical efficiency loss. For the first two, such loss is due to a scale efficiency decline (− 8.4% and − 4.7, respectively).

Table 2 Malmquist index and its components. Source: own elaboration

	Index	TEC	TC
LIGURIA	0.81	0.98	0.82
TUSCANY	0.90	1.10	0.82
BASILICATA	0.89	1.09	0.82
PUGLIA	1.10	1.33	0.82
ABRUZZO	1.01	1.23	0.82
LAZIO	0.89	1.08	0.82
EMILIA-ROMAGNA	0.90	1.09	0.82
CALABRIA	0.95	1.15	0.82
TRENTO Aut. Prov	1.00	1.21	0.82
UMBRIA	0.98	1.19	0.82
AOSTA VALLEY	1.02	1.23	0.82
SICILY	1.14	1.38	0.82
FRIULI -VENEZIA GIULIA	0.66	0.80	0.82
MOLISE	1.06	1.28	0.82
PIEDMONT	0.91	1.10	0.82
LOMBARDY	0.79	0.96	0.82
CAMPANIA	0.97	1.18	0.82
MARCHE	0.95	1.15	0.82
VENETO	0.85	1.03	0.82

Sardinia and Bolzano Autonomous Province are not included because of missing data

[19] The index is obtained as follows: $\mathrm{MPI}_{t,t+1} = \sqrt{\mathrm{MPI}_t \times \mathrm{MPI}_{t+1}} = \sqrt{\frac{D_{t+1}^{t}}{D_t^t}\frac{D_{t+1}^{t+1}}{D_t^{t+1}}}$ $= \sqrt{\frac{D_{t+1}^{t+1}}{D_t^t}\frac{D_t^t}{D_t^{t+1}}\frac{D_{t+1}^t}{D_{t+1}^{t+1}}}$ where D represents the distance of each observation unit in the input–output space, the subscript (t or $t+1$) represents the set of inputs/outputs at a specific time and the superscript (t or t + 1) represents the time when the frontier is set.

[20] Mancuso and Valdmanis [38] also observe technological regress in hospital care services.

Table 3 Drivers of regional expenditure on residential LTC

		Variable	Source
Demand factors	Demographic	Dependency index (*dep_ind*)	ISTAT-population and households
		Share of people aged over-65 with two or more chronic diseases every 1000 persons (*cronic*)	ISTAT-health for all
		Number of healthy life years at 65 (*healthylife_exp_M* for men; *healthylife_exp_F*, for women)	ISTAT-health for all
		Life expectancy at age 65 (*life_exp*)	ISTAT-population and households
	Social	Share of families of single persons aged over 65 (*fam_single_ + 65*)	ISTAT-health for all
		Share of over-65 people who live alone (*lonely_ + 65*)	ISTAT-health for all
		Gini index (*gini*)	ISTAT-household economic conditions and disparities
	Market	Unemployment rate of women aged 15–64 (*unempw15_64*), 45–54 (*unempw45_54*) and 55–64 (*unempw55_64*)	ISTAT-labor and wages
		Female participation rate in the labor market (*part_rate*)	ISTAT-labor and wages
Institutional factors	Decentralization	Dummy for regions with a recovery plan (*pr*) or a commissioner in charge of the recovery plan (*prc*)	Ministry of the interior
		Regional current revenues (*curr_rev*)	ISTAT-local finance
		Regional own taxes (*own_tax*)	ISTAT-local finance
		Special statute regions dummy (*rss*)	

No change characterizes, instead, the Autonomous Province of Trento.

Consequently, also considering the limitations of this analysis and given the unavailability of other input and output indicators, we can conclude that the trends in regional spending and equivalent beds observed in Sect. 3 can be related to efficiency improvements only for a limited number of regions.

Further considerations can, however, be retrieved from the ISTAT survey on all health and social-care facilities.[21] From 2010 to 2016 (the last survey), these structures have changed their profile and enhanced their role of healthcare providers: the number of over-65 inpatients requiring intensive health care has increased by 36%, while inpatients with no health needs have decreased by 42%. While the health needs of elderly inpatients have increased, facilities have undergone[22] a reduction in medical staff (− 22% for specialist doctors, − 15% for general practitioners), nurses (− 10%) and an increase in the number of low-skilled care assistants (+ 38%). Therefore, the regional efficiency performances could signal reduced costs to the detriment of effectiveness and quality of services.

The growing presence of private companies[23] in the sector could also play a role in the efficiency results because private institutions can reduce personnel costs by adopting less expensive employment contracts than those applied in public structures [30]. The LTCF business has become increasingly attractive for private investors because it is credited with an average rate of return of 6–7%[24] and low risk, given that the Regional Health Service guarantees from 50 to 100% of the fees depending on the level of care and the presence of cognitive problems.

The empirical strategy

We now turn to our main research question and examine which factors drive the spatial distribution of residential healthcare and have spurred its concentration in some areas.

[21] http://dati.istat.it/Index.aspx?DataSetCode=DCIS_PRESIDI1.

[22] No specific data for staff are available for facilities hosting mainly persons aged over-65.

[23] According to ISTAT (2018), 48.6% of beds in all health and social-care facilities is in non-profit institutions, followed by for-profit (26.1%) and public (25.3%) institutions. Lombardy has the highest share of non-profit structures (66.8%). http://dati.istat.it/Index.aspx?DataSetCode=DCIS_PRESIDI1.

[24] Sole24ore 14 October 2019, https://www.ilsole24ore.com/art/residenze-anziani-mercato-crescita-costante-ACN2Qnp. https://www.ilsole24ore.com/art/residenze-anziani-mercato-crescita-costante-ACN2Qnp. Among the for-profit companies, there is a prevalence of big industrial and financial groups that are active in the Northern Regions. However, the rate of industrial concentration achieved by the Italian LTC sector is still extremely modest, especially when compared to the domestic healthcare sector or the international LTC markets [39].

The literature on the emergence of spatial differences in healthcare and health outcome focuses on the interplay of both region-specific demand factors (demographic trends, health needs, the social context) and institutional factors (decentralization, in particular). Alongside a series of records on regional characteristics, we focus on a specific line of expenditure—regional expenditure on residential LTC for the over-65 age group (instead of the more used overall level of health expenditure)—which allows us to employ age-specific variables (Table 3). The choice of the drivers is also guided by the literature on health spending determinants [13, 14, 40, 41], which is, however, more focused on spending differentials and potential saving margins or health outcomes.

The empirical analysis: demand and institutional factors

The evidence provided by the empirical literature suggests correlations between health expenditure and demand factors related to demography and health conditions. The relationship between demographic change and LTC spending is found to be stronger than the one with health expenditure, given that a high share of LTC patients is over 65 [42, 43]. Following the literature on LTC projections [44, 45], a positive relationship between residential healthcare spending and age is assumed. We consider the dependency index (*dep_ind*), measuring the ratio of over-65 persons to young persons (from 0 to 14), as representative of a "pure aging effect".

Age-specific features drive the line of expenditure under exam. As LTC is significantly associated with higher longevity, we consider the life expectancy at age 65 (*life_exp*). Besides, as longer life can be associated with an increase in the prevalence of chronic diseases [46, 47], we also introduce two measures of frailty, the number of healthy life years at 65 (for men, *healthylife_exp_M*, and women *healthylife_exp_F*) and the share of people aged over 65 with two or more chronic diseases (*cronic*).

The pressure for institutionalized care stems also from structural changes in society, in particular the reduction in family size and the increase in the number of households made up of single elderly people. In presence of chronic diseases and low family support, this increases the probability for the elderly to be moved into a nursing home [48]. These features enter our empirical specification via the share of families of single persons aged over 65 (*fam_single_+65*). A sensitivity check (Table 6, Model 1a) employs the share of over-65 people who live alone (*lonely_+65*).

To complete the records on regional characteristics, we consider a proxy for inequality. According to Andersen [49], the demand for care is driven by needs (health status), predisposing factors (age) and enabling factors (marital and tenancy status and income/wealth). Considering that the access to formal care services is means-tested, older people in lower socio-economic groups are the most likely to apply for public sector help. Thus, larger inequalities should demand more generous public provision. We employ the Gini index (*gini*) to account for economic inequality.

We omit other variables relating to the economic situation, such as the regional per capita income, to try to control only for the characteristics of demand and avoid possible correlations with the supply side [21], due, for example, to the number and quality of private providers. Besides, following the results in Cantanero Prieto and Lago-Peñas [14] and Crivelli et al. [10], we deem that, when the levels of service provision are set by the Central Government and fiscal equalization is strong—as they are in Italy—results for regional income are difficult to interpret. Still, being correlated with other economic variables, income variables would cause the insurgence of multicollinearity problems.

We, then, consider the influence exerted by the informal care market, whose presence and extent are shaped by cultural factors [50]. In Italy, the family is considered "the care agency" [51] and enjoys some limited public support (e.g., the carer's allowance) [52]. This shapes the informal care market, where assistance to dependent elderly is generally provided by women. Evidence supports a negative association between informal elderly care and female labor force participation [53], particularly for mid-life women[25] [54, 55] and southern European countries [50].

However, while the lack of LTC services has an impact on women's participation in the labor market, the reverse is also true and the presence of large numbers of potential family caregivers reduces the pressure on regional governments to spend on public care services. This situation is more likely when the provision of in kind services is limited and cash benefits for frail elderly people are distributed without rules on their employment and can be used to purchase services within the family.

We test the hypothesis that the presence of a basin of unemployed women reduces the demand of formal care [24]. The variable considered is the unemployment rate of women aged between 15 and 64 (*unempw15_64*). A sensitivity check (Table 6, Model 8a, 8b, 8f) was also carried out using unemployment rates for the 45–54 (*unempw45_54*) and 55–64 (*unempw55_64*) cohorts, which should be those more involved in informal care [15], and the female participation rate in the labor market (*part_rate*, available only for the 15–64 age group).

[25] According to Naldini, et al. [43] 15% of mid-life working women in Italy have reduced their labour-market participation due to caring responsibilities of their elderly parents. This percentage is 5% in Scandinavian countries and 8% in Central European countries.

As most of the existing literature underlines, regional expenditure on LTCF depends on the devolution framework and the financial resources that it makes available. A basic tenet of fiscal federalism is that when financing is primarily based on common pool resources—Central Government transfers or shared revenues (where fiscal autonomy is null or low)—local governments are tempted by overspending [56]. The positive effects of fiscal autonomy on politicians' accountability and local public finances [57, 58] are not confirmed by conclusive evidence [59, 60]. Studies of the impact of decentralization on inequality of health expenditures and outcomes in Italy also provide mixed evidence [8, 20, 21, 61, 62].

To control for the decentralization features, we first consider the financial resources of regions and their composition. Regional current revenues, *curr_rev*,[26] are expected to positively impact on the financing of healthcare in LTCF. A robustness check is performed by employing the amount of regional own taxes (Table 6, Model 8c), *own_tax* (a regional tax on productive activities and a personal income surtax), which are unevenly distributed across regions due to differences in their tax bases. Even if the equalization system compensates for the different fiscal capacity, the composition of financing in richest regions—which depend more on own resources and less on transfers and whose financing and spending powers are better aligned—grants them greater fiscal autonomy, increases the accountability of their local officials [63–65] and should result in better services and greater access to them [57, 66].

The financial accountability of regional governments is reinforced by provisions aimed at ensuring essential levels of services and preventing that the use of intergovernmental transfers "softens" regional budget constraints and affects the sustainability of public finances. Persistent deficits oblige regions to adopt a recovery plan and—in the event of a serious breach—to transfer their health policy to a commissioner. Studies on the impact of recovery plans show mixed evidence: positive results in terms of cost containment are balanced by mixed results in terms of equity and service quality [67], while other studies point to a negative impact on hospitalization and mortality rates, without gains in terms of efficiency [68]. We introduce a dummy for those regions where a commissioner has been appointed (*prc*). A robustness check is also performed using a dummy for those regions that submit only a recovery plan (*pr*). We have no prior on the effect of the recovery plan. Overall, it should drive containment of residential care spending—which is not as politically sensitive as health [69]. However, some regions may increase LTCF spending if their gap with national standards is severe.

Finally, we consider that the group of Special Statute Regions (Friuli Venetia-Giulia, Aosta Valley, Sicily, Sardinia and the Autonomous Provinces of Trento and Bolzano) constitutionally enjoy special autonomy, follow different rules, and have broader expenditure assignments. To consider their different status, a dummy is added (*rss*).

The model and results

Our empirical strategy is based on a pooled OLS estimation,[27] corrected for heteroschedasticity, which is used for estimating the following general model specification (Eq. 1) over the sample of 19 regions and two Autonomous Provinces[28] and over the period 2010–18:

$$\begin{aligned}\log\_reg\_exp_i = {} & \beta_0 + \beta_1 dep\_ind_i + \beta_2 life\_exp_i \\ & + \beta_3 cronic_i + \beta_4 fam\_single\_ + 65_i \\ & + \beta_5 curr\_rev_i + \beta_6 unempw15\_64_i \\ & + \beta_7 gini_i + \beta_8 prc_i + \varepsilon_i.\end{aligned} \tag{1}$$

Following the established procedure, an initial analysis of the data as well as the usual checks for the absence of multicollinearity (mean VIF = 2.54), omitted variables (Ramsey reset test: p value = 0.24) and misspecifications (link test: _hatsq p value = 0.24) has been performed.

The dependent variable is the regional expenditure on residential LTC as a ratio to over-65 residents (*reg_exp*) and to cope with very wide data ranges (Table 5) and eventually skewed distributions, we adopt a log transformation of this variable and of the regional revenues among the regressors.

Table 4 shows the estimated impact of the selected variables under alternative specifications of Eq. (1). In all models, regional expenditure seems to be mainly driven by market and institutional factors. The role of demographic and social factors is confirmed, but it gives rise to paradoxical results. Only the dependency index has the expected positive coefficient, while the variables for the health status of elderly people have coefficients with signs opposite to those expected.

In all models, the estimated coefficient of life expectancy at the age of 65 is positive and statistically significant, and conversely that for the share of elderly people with chronic diseases is negative, but not always significant. In the sensitivity checks, also the number of healthy life years has a positive sign, which is significant for the index of the male

[26] Current revenues are the sum of own, devolved and transferred taxes, transfers and revenues from services and rents.

[27] Because of the limited number of observations, it is not possible to run a fixed effect model (which would have been our first choice), because, even without entering any regressor, we run into model overfitting.

[28] The Autonomous Provinces of Bolzano and Trento constitute the Special Statute Region Trentino-Alto Adige.

Table 4 The impact of demand and institutional factors on residential LTC expenditure

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
dep_index	0.076**	0.030*	0.026**	0.014	0.014	0.093**	0.035*	0.054**
life_exp		0.980**	0.542**	0.486**	0.484**	0.296	0.644**	0.628**
cronic			− 0.070**	− 0.044**	− 0.039**	− 0.041**	− 0.015	− 0.005
unempw15_64				− 0.053**	− 0.046*	− 0.041*	− 0.050**	− 0.052**
Gini					− 4.37	− 3.179	− 10.94**	− 10.42**
fam_single_ + 65						− 0.237**	− 0.015	− 0.038
logcurr_rev							0.671**	0.690**
rss								0.382**
Cons	2.472**	− 16.10**	− 2.917	− 2.186	− 1.316	3.133	− 19.65**	− 20.86**
N	189	189	189	189	168	168	168	168
R-sq	0.090	0.271	0.423	0.452	0.471	0.526	0.666	0.682
Adj. *R*-sq	0.0856	0.263	0.414	0.441	0.454	0.508	0.651	0.666

*$p < 0.10$, **$p < 0.05$

population (Table 6, model 8e). Thus, the spatial distribution of regional expenditure for residential healthcare does not mirror the distribution of frailties and potential needs of the elderly.

Analyzing the social characteristics, similar unexpected results are observed, given that the share of families of single persons aged over 65 (*fam_single_ + 65*) has a negative coefficient, which is not always significant. The same is true when replacing this variable with the percentage of over-65 people who live alone (*lonely_ + 65*) (Table 6, model 8c). Gini inequality index confirms the paradox with a negative and significant coefficient, supporting the idea that regional funding of residential healthcare is not pro-poor.

These results imply a disconnection between the distribution of public expenditure and the distribution of the real health and social needs among the elderly population. Thus, while the devolution of health policy responsibility to decentralized governments implies the acceptance of a certain degree of differentiation in services provision—even when equality is granted at constitutional level—the striking result for the spatial distribution of residential care expenditure in Italy is not so much its unevenness, rather its incongruence with respect to parameters of health and social need.

Of particular relevance is the result for the female unemployment rate coefficient. A significant effect exists between formal regional assistance and informal help, and the negative coefficient of the unemployment rate of women (aged 15–64) supports the idea that a basin of unemployed potential carers reduces the demand of formal residential assistance. This result contrasts the findings for overall health expenditure in Francese and Romanelli [13] and in Crivelli et al. [10], where the unemployment rates are not statistically significant. The coefficient is no more significant when looking at mid-life cohorts, meaning that the relevant indicator for regional policymaking is the overall unemployment rate (Table 6, model 8a–8b). The role of women as potential caregivers is confirmed when considering the female participation rate in the labor market (Table 6, model 8f).

When turning to the role of decentralization, we observe that financial resources affect regional expenditures on LTCF. Both current revenues (Table 4) and own resources (Table 6, model 8d) show a positive and statistically significant coefficient. Regions with more own resources enjoy greater fiscal autonomy and are in a better position to expand residential healthcare for the elderly.

Fiscal constraints, proxied by the appointment of a commissioner for the recovery plan, have the expected negative sign, but are not significant: for this reason, we present the result in the annex (Table 6, model 8g). The same holds true when considering the dummy for regions with only a recovery plan (Table 6, model 8 h). This result of not binding constraints may be due to the fact that the Central–Southern Regions obliged to recovery plans or commissioners are also those where gaps with respect to national service standards are greater. Since gap reduction is an essential part of the recovery plans, regions must increase their expenditure in residential LTC even in presence of financial constraints.

Finally, as expected, the presence of the regions with a special statute positively influences expenditures, because their financial resources and their margin of autonomy are greater than in ordinary statute regions.

Our findings showing the existence of a pro-rich and pro-market regional distribution of residential LTC may be useful to support a discussion on future LTC reforms. While focusing on one single specific line of expenditure in one country limits the external validity of results, it however contributes to a deeper understanding of regional policy choices and their drivers. The study finds its limitations in the lack of complete data on nursing homes, which would allow a better understanding of the differentials in expenditure. Data on the

characteristics of the supply and on the appropriateness of institutionalization in residential structures would allow to analyze the unexplained variability observed in the levels of expenditure. However, at present, the residential LTC system in Italy cannot rely on an integrated information system of the services provided [27].

Conclusion

The spatial distribution of LTCF in Italy shows peculiarities that deserve investigation. Italian regional governments are responsible for residential healthcare services for frail elderly within the devolution framework and the standards set by the Central Government. This mix of regional autonomy and constraints compounds with demand and market factors in delivering the spatial distribution of LTCF.

Given the poor data on the number and characteristics of LTCF, we investigate the factors that drive the allocation of the regional expenditure on LTCF. Our results indicate the prevalence of available financial resources and market factors over demographic factors and the health and social needs of the elderly. The expenditure is concentrated in richer and more autonomous regions rather than in those where chronicity or health needs are sharper. The negative relationship between residential care expenditure and female unemployment (the basin of potential caregivers) confirms the importance of market factors for public policy orientation and the still gendered character of care work, a low-paid and often precarious job, where working conditions are often suboptimal. This result suggests that, if LTCF distribution is mainly driven by market and institutional factors, the role of residential services in responding to the needs of frail elderly should be reconsidered.

The critical issues of LTC services for frail elderly people, namely a highly fragmented, market-driven provision, could be addressed only by a national reform. This requires resources, the establishment of better national standards for regionally managed LTC systems, and the development of new models of aged care. A chain of care should stepwise connect community, home and residential care, while respecting the elderly people's will, enhancing their still present autonomy and protecting them from epidemic shocks.[29]

Conflict of interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

Appendix

See Tables 5 and 6.

Table 5 Summary statistics of the variables employed in model 8 (Table 4)

Variables	Obs	Mean	Std. dev	Min	Max
reg_exp	189	259.42	1.18	3.94	1280.11
dep_ind	189	34.14	4.70	23.6	47.1
life_exp	189	20.52	0.56	18.8	21.9
cronic	189	57.53	7.45	32.1	73.34
unempw15_64	189	12.44	5.74	3.08	26.59
gini	168	0.28	0.03	0.23	0.4
fam_single_+65	189	14.93	1.86	10.93	20.65
curr_rev	189	7.83e+09	0.83	9.07e+08	2.57e+10
rss	189	0.29	0.45	0	1

[29] New investments are included in Italy's Recovery and Resilience Plan: 7 bn euro for home, semi-residential services and Community Hospitals, essential levels of services for dependent elderly, interventions to prevent the institutionalization of the frail elderly and to convert nursing homes into apartment groups. At least 4.3 bn euro will finance targeted services for dependent elderly.

Table 6 Sensitivity checks

	Model 8	Model 8a	Model 8b	Model 8c	Model 8d	Model 8e	Model 8f	Model 8g	Model 8h
dep_ind	0.054**	0.063**	0.067**	0.038**	0.058**	0.12**	0.027	0.053**	0.055**
life_exp	0.628**	0.572**	0.634**	0.705**	0.606**		0.458**	0.624**	0.623**
Cronic	− 0.005	− 0.028**	− 0.017	− 0.002	− 0.014		− 4.3E− 05	− 0.005	− 0.005
unempw15_64		− 0.052**		− 0.051**	− 0.036*	− 0.032*		− 0.052**	− 0.050**
Gini	− 10.42**	− 15.26**	− 11.93**	− 11.69**	− 10.45**	− 12.62**	− 11.05**	− 10.34**	− 10.57**
fam_single_+65	− 0.038	− 0.054	− 0.053		− 0.083	− 0.138**	− 0.019	− 0.036	− 0.037
curr_rev	0.690**	0.649**	0.682**	0.741**		0.666**	0.612**	0.685**	0.697**
Rss	0.382**	0.350**	0.351**	0.330**	0.695**	0.409	0.348**	0.367**	0.389**
unempw55_64		0.0409							
unempw45_54			− 0.0408						
lonely_+65				0.0173					
own_tax					0.407**				
healthylife_exp_F						0.0761			
healthylife_exp_M						− 0.0817			
part_rate							0.053**		
Prc								− 0.04	
Pr									− 0.054
cons	− 20.86**	− 17.02**	− 20.19**	− 23.90**	− 12.75**	− 8.22**	− 19.16**	− 20.67**	− 20.93**
N	168	168	168	168	168	136	168	168	168
R-sq	0.682	0.661	0.666	0.683	0.655	0.664	0.689	0.682	0.682
Adj. *R*-sq	0.666	0.643	0.650	0.667	0.637	0.643	0.674	0.664	0.664

*$p < 0.10$, **$p < 0.05$

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References

1. Fosti, G., Notarnicola, E.: 2° Rapporto Osservatorio Long Term Care. Cergas-Bocconi, Egea, Milan (2019). https://www.cergas.unibocconi.eu/wps/wcm/connect/99aaf88a-1c66-42ec-add9-df76ae31a5d8/fosti_notarnicola.pdf?MOD=AJPERES&CVID=mRDrVdE. Accessed 24 Nov 2020
2. ECDC: High impact of COVID-19 in long-term care facilities, suggestion for monitoring in the EU/EEA. Euro Surveill. **5**(2), 14–18 (2020)
3. de Girolamo, G., Bellelli, G., Bianchetti, A., Starace, F., Zanetti, O., Zarbo, C., Micciolo, R.: Older people living in long-term care facilities and mortality rates during the COVID-19 pandemic in Italy: preliminary epidemiological data and lessons to learn. Front. Psychiatry **11**, 586524 (2020)
4. Ancidoni, A., Bacigalupo, I., Bellomo, G., Canevelli, M., Carbonari, P., Carella, M.G. et al.: Survey nazionale sul contagio COVID-19 nelle strutture residenziali e sociosanitarie. Istituto Superiore di Sanità (2020). https://www.epicentro.iss.it/coronavirus/pdf/sars-cov-2-survey-rsa-rapporto-finale.pdf. Accessed 15 Dec 2020
5. Yen, M.Y., Schwartz, J., King, C.C., Lee, C.M., Hsueh, P.R.: Recommendation on protection from and mitigation of COVID-19 pandemic in long term care facilities. J. Microbiol. Immunol. Infect. **53**(3), 447–453 (2020)
6. Lombardo, F.L., Salvi, E., Lacorte, E., Piscopo, P., Mayer, F., Ancidoni, A., Remoli, G., Bellomo, G., Losito, G., D'Ancona, F., Canevelli, M., Onder, G., Vanacore, N.: and The Italian National Institute of Health Nursing Home Study Group: adverse events in Italian Nursing homes during the COVID-19 epidemic: a national survey. Front. Psychiatry **11**, 578465 (2020). https://doi.org/10.3389/fpsyt.2020.578465
7. Liotta, G., Marazzi, M.C., Orlando, S., Palombi, L.: Is social connectedness a risk factor for the spreading of COVID-19 among older adults? The Italian paradox. PLoS ONE (2020). https://doi.org/10.1371/journal.pone.0233329
8. Giannoni, M., Hitiris, T.: The regional impact of health care expenditure: the case of Italy. Appl. Econ. **34**(14), 1829–1836 (2002)
9. Di Matteo, L., Di Matteo, R.: Evidence on the determinants of Canadian provincial government health expenditures: 1965–1991. J. Health Econ. **17**, 211–228 (1998)
10. Crivelli, L., Filippini, M., Mosca, I.: Federalism and regional health care expenditures: an empirical analysis for the Swiss cantons. Health Econ. **10**(1), 20–26 (2005)
11. Di Matteo, L.: The income elasticity of health care spending A comparison of parametric and nonparametric approaches. Eur. J. Health Econ. **4**, 20–29 (2003)

12. Di Matteo, L.: The macro determinants of health expenditure in the United States and Canada: assessing the impact of income, age distribution and time. Health Policy **71**, 23–42 (2005)
13. Francese, M., Romanelli, M.: Is there room for containing healthcare costs? An analysis of regional spending differentials in Italy. Eur. J. Health Econ. **15**, 117–132 (2014)
14. Cantanero Prieto, D., Lago-Peñas, S.: Decomposing the determinants of health care expenditure: the case of Spain. Eur. J. Health Econ. **13**, 19–27 (2012)
15. Costa-Font, J., Pons-Novell, J.: Public health expenditure and spatial interactions in a decentralized national health system. Health Econ. **16**, 291–306 (2007)
16. Lopez-Casanovas, G., Saez, M.: A multilevel analysis on the determinants of regional health care expenditure. A note. Eur. J. Health Econ. **8**, 59–65 (2007)
17. Zhong, H.: The impact of decentralization of health care administration on equity in health and health care in Canada. Int. J. Health Care Financ. Econ. **10**(3), 219–237 (2010)
18. Kessler, A.S., Hansen, N.A., Lessmann, C.: Interregional redistribution and mobility in federations: a positive approach. Rev. Econ. Stud. **78**(4), 1345–1378 (2011)
19. Costa-Font, J., Rico, A.: Devolution and the interregional inequalities in health and healthcare in Spain. Reg. Stud. **40**(8), 875–887 (2006)
20. Costa-Font, J., Turati, G.: Regional health care decentralization in unitary states: equal spending, equal satisfaction? Reg. Stud. **52**(7), 974–985 (2017)
21. Rodriguez-Pose, A., Ezcurra, R.: Does decentralization matter for regional disparities? A cross-country analysis. J. Econ. Geogr. **10**, 619–644 (2010)
22. Di Novi, C., Piacenza, M., Robone, S., Turati, G.: Does fiscal decentralization affect regional disparities in health? Quasi-experimental evidence from Italy. Reg. Sci. Urban Econ. **78**(8), 1–14 (2019)
23. ESPN: ESPN thematic report on challenges in long-term care—Italy. European Social Policy Network (2018). https://ec.europa.eu/social/BlobServlet?docId=19853&langId=en
24. Da Roit, B., Sabatinelli, F.: Nothing on the move or just going private? Understanding the freeze on child- and eldercare policies and the development of care markets in Italy. Soc. Polit. **20**(3), 430–453 (2013)
25. Knijn, T., Hiah, J.: Just care for the elderly and disabled. In: Knijn, T., Lepianka, D. (eds.) Justice and vulnerability in Europe. An Interdisciplinary Approach, pp. 160–177. E.Elgar, Cheltenham (2020)
26 Naldini, M.: Le politiche sociali in Europa. Trasformazione dei bisogni risposte di policy. Carocci, Rome (2020)
27. Berloto, S., Perobelli, E.: Dalla Silver Economy al settore LTC in Italia: dati, sviluppi e tendenze in atto. In: Fosti G., Notarnicola E (eds) 2° Rapporto Osservatorio Long Term Care, Cergas- Bocconi, Egea, Milan (2019). https://www.cergas.unibocconi.eu/wps/wcm/connect/99aaf88a-1c66-42ec-add9-df76ae31a5d8/fosti_notarnicola.pdf?MOD=AJPERES&CVID=mRDrVdE. Accessed 24 Nov 2020
28. Costa-Font, J.: Devolution, diversity and welfare reform: long-term care in the 'Latin Rim.' Soc. Policy Adm. **44**(4), 481–494 (2010)
29. Tediosi, F., Gabriele, S.: Long-term care in Italy. ENEPRI research report no. 80 (2010). https://www.ceps.eu/ceps-publications/long-term-care-system-elderly-italy/. Accessed 15 Nov 2020
30 Arlotti, A., Ranci, F.: The impact of COVID-19 on nursing homes in Italy. J. Aging Soc. Policy (2021). https://doi.org/10.1080/08959420.2021.1924344
31. Coelli, T.J., Rao, D.S.P., O'Donnell, C.J., Battese, G.E.: An introduction to efficiency and productivity analysis. Springer US, New York (2005)
32. Boussofiane, A., Dyson, R., Rhodes, E.: Applied data envelopment analysis. Eur. J. Oper. Res. **52**(1), 1–15 (1991)
33 Yong-Bae, J., Choonjoo, L.: Data envelopment analysis. Stata J. **10**(2), 267–280 (2010)
34. Sarkis, J.: Preparing your data for DEA. In: Zhu, J., Cook, W.D. (eds.) Modelling data irregularities and structural complexities in data envelopment analysis, pp. 305–320. Springer, Heidelberg (2007)
35. Daraio, C., Simar, L.: Conditional nonparametric frontier models for convex and nonconvex technologies: a unifying approach. J. Prod. Anal. **28**(1–2), 13–32 (2007)
36. Malmquist, S.: Index numbers and indifference surfaces. Trab. Estad. **4**, 209–242 (1953)
37. Caves, D.W., Laurits, R.C., Diewert, W.E.: The economic theory of index numbers and the measurement of input, output, and productivity. Econometrica **50**(6), 1393–1414 (1982)
38. Mancuso, P., Valdmanis, V.G.: Care appropriateness and health productivity evolution: a non-parametric analysis of the Italian regional health systems. Appl. Health Econ. Health Policy **14**(5), 595–607 (2016). https://doi.org/10.1007/s40258-016-0257-y. (**PMID: 27448211**)
39. Notarnicola, E.: I gestori del settore LTC: dati e trend. In: Fosti, G., Notarnicola, E. (eds.) L'innovazione e il cambiamento nel settore della Long Term Care, pp. 49–70. EGEA, Milan (2018)
40. Nixon, J., Ulmann, P.: The relationship between health care expenditure and health outcomes. Eur. J. Health Econ. **7**, 7–18 (2006)
41. Vatter, A., Rüefli, C.: Do political factors matter for health care expenditure? A comparative study of Swiss cantons. J. Public Policy **23**(3), 301–323 (2003)
42. Yang, Z., Norton, E.C., Stearns, S.C.: Longevity and health care expenditures the real reasons older people spend more. J. Gerontol. B. Psychol. Sci. Soc. Sci. **58**(1), S2-10 (2003). https://doi.org/10.1093/geronb/58.1.s2. (**PMID: 12496303**)
43. Marino, A., James, C., Morgan, D., Lorenzoni, L.: Future trends in health care expenditure: a modelling framework for cross-country forecasts. OECD health working paper no. 95 (2017). https://www.oecd-ilibrary.org/social-issues-migration-health/future-trends-in-health-care-expenditure_247995bb-en. Accessed 12 Dec 2020
44. Martins, O.J., de la Maisonneuve, C.: The drivers of public expenditure on health and long-term care: an integrated approach. OECD Econ. Stud. **2**, 115–154 (2006). https://doi.org/10.2139/ssrn.917782
45. Jin, X., Mori, T., Sato, M., Watanabe, T., Noguchi, H., Tamiya, N.: Individual and regional determinants of long-term care expenditure in Japan: evidence from national long-term care claims. Eur J Public Health **30**, 873–878 (2020)
46. Sicsic, J., Ravesteijn, B.: Rapp, T: Are frail elderly people in Europe high-need subjects? First evidence from the SPRINTT data. Health Policy **124**(8), 865–872 (2020)
47 Goldman, D.P., Shang, B., Bhattacharya, J., Garber, A.M., Hurd, M., Joyce, G.F., Lakdawalla, D.N., Panis, C., Shekelle, P.: Consequences of health trends and medical innovation for the future elderly. Health Aff. (2005). https://doi.org/10.1377/hlthaff.w5.r5
48. Thomeer, M.B., Mudrazija, S., Angel, J.L.: Relationship status and long-term care facility use in later life. J. Gerontol. B. Psychol. Sci. Soc. Sci. **71**, 711–723 (2016)
49. Andersen, R.M.: Revisiting the behavioral model and access to medical care: does it matter? J. Health Soc. Behav. **36**, 1–10 (1995)

50. Naldini, M., Pavolini, E., Solera, C.: Female employment and elderly care: the role of care policies and culture in 21 European countries. Work Employ Soc. **30**(4), 607–630 (2016)
51. Saraceno, C.: Mutamenti della famiglia e politiche sociali in Italia. Il Mulino, Bologna (2003)
52. Da Roit, B., Naldini, M.: Should I stay or should I go? Combining work and care for an older parent in Italy. South Eur Soc Polit **15**(4), 531–551 (2010)
53. Viitanen, T.K.: Informal Elderly Care and Female Labour Force Participation Across Europe. Center for European Policy Studies, ENEPRI research reports no. 13 (2005). https://www.ceps.eu/ceps-publications/informal-elderly-care-and-womens-labour-force-participation-across-europe/. Accessed 9 Dec 2020
54. Crespo, L.: Caring for parents and employment status of European mid-life women. CEMFI working paper no. 0615 (2006). https://www.cemfi.es/ftp/wp/0615.pdf. Accessed 20 Dec 2020
55. Henz, U.: Informal caregiving at working age: effects of job characteristics and family configuration. J. Marriage Fam. **68**(2), 411–429 (2006)
56. Ashworth, J., Galli, E., Padovano, F.: Decentralization as a constraint to Leviathan: a panel cointegration analysis. Public Choice **156**(3/4), 491–516 (2013)
57. Eyraud, L., Lusinyan, L.: Vertical fiscal imbalances and fiscal performance in advanced economies. J. Monet. Econ. **60**(5), 571–587 (2013)
58. Foremny, D.: Sub-national deficits in European countries: the impact of fiscal rules and tax autonomy. Eur. J. Polit. Econ. **34**, 86–110 (2014)
59. de Mello, L.: Can fiscal decentralization strengthen social capital? Public Financ. Rev. **32**(1), 4–35 (2004)
60. Thornton, J.: The (non) impact of revenue decentralization on fiscal deficits: some evidence from OECD countries. Appl. Econ. Lett. **16**(14), 1461–1466 (2009)
61. Blöchliger, H., Bartolini, D., Stossberg, S.: Does Fiscal Decentralisation Foster Regional Convergence? OECD Economic Policy Paper No. 17 (2016)
62. Toth, F.: How health care regionalization in Italy is widening the North-South gap. Health Econ. Policy Law **9**(3), 231–249 (2014)
63. Bordignon, M., Turati, G.: Bailing out expectations and public health expenditure. J. Health Econ. **28**, 305–321 (2009)
64. Piacenza, M., Turati, G.: Does fiscal discipline towards sub-national governments affect citizens' well-being? Evidence on health. Health Econ. **23**(2), 199–224 (2014)
65. Cavalieri, M., Ferrante, L.: Does fiscal decentralization improve health outcomes? Evidence from infant mortality in Italy. Soc. Sci. Med. **164**, 74–88 (2016)
66. Cavalieri, M., Ferrante, L.: Convergence, decentralization and spatial effects: an analysis of Italian regional health outcomes. Health Policy **124**(2), 164–173 (2020)
67. Aimone Gigio, L., Alampi, D., Camussi, S., Ciaccio, G., Guaitini, P., Lozzi, M., Mancini, A.L., Panicara, E., Paolicelli, M.: La sanità in Italia: il difficile equilibrio tra vincoli di bilancio e qualità dei servizi nelle regioni in piano di rientro. Bank of Italy. Occasional Paper No. 427 (2018)
68. Depalo, D.: The side effects on health of a recovery plan in Italy: a nonparametric bounding approach. Reg. Sci. Urban Econ. **78**, 1–22 (2019)
69. Toubeau, S., Vampa, D.: Adjusting to austerity: the public spending responses of regional governments to the budget constraint in Spain and Italy. J. Publ. Policy (2020). https://doi.org/10.1017/S0143814X20000094