One Plus One Makes Less than Two? The Impact of Italian Local Health Authorities Consolidation Process on Population Mortality

Preliminary Draft

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Abstract

This paper evaluates the impact of Local Health Authorities consolidation process on population mortality within Italian municipalities from 2002 to 2016. We focus on the wave of mergers that took place from 2004 and are still in progress in some regions. We estimate the impact of these policy shifts on population mortality using the within municipality variation over time, distinguishing between the geographical characteristics of municipalities (mountain Vs. non-mountain) and controlling for individual municipality trends. Since each region set up the policy in different years, we use a staggered difference in difference as identification strategy to estimate the average treatment effect, capturing and disentangling the full dynamics both in the short run and in the medium-long run. Our findings show that population mortality increased in the years following the reform and suggest that policy makers should carefully consider the impact on health care effectiveness before allowing more mergers.

Keywords: Local Health Authorities amalgamation; Mortality; Health care quality

JEL classification: I11 I18 L32 L38

1 Introduction

Over the last decades, in Italy, the increase of life expectancy and the consequent aging of population raised concerns on the dynamics of health spending in such a way that institutional settings have changed and policies mostly oriented at containing costs and increasing efficiency have been implemented. The consolidation of Local Health Authorities (LHAs in what follows) represents a prominent example of this pattern and it is the focus of this study. Indeed, the Italian LHAs experienced a drastic reduction of their number, passing from 659 in 1992 to 197 in 2001 (Di Novi *et al.*, 2018), resulting 139 in 2015 and 101 in 2017 (Italian Ministry of Health, 2018).

This paper seeks to answer the question: does the amalgamation of two or more LHAs affect the quality of provided care?

The question of whether Italian LHAs amalgamation programs affect the quality of health care for patients has not been answered yet and would represent a further step in the debate regarding the effects of mergers. Thus, the motivation of this analysis relies on giving some evidence on the indirect effects that this "merging mania" may produce. In fact, the more straightforward direct effects are related to cost-saving benefits by cutting off the number of General Managers and administrative staff. Given this precious strength, from a theoretical perspective, the maximum benefit would be obtained by establishing a single LHA per region or a single LHA for the whole country. Nevertheless, it seems reasonable that this merging design may have some weaknesses and produce, eventually, a worsening of the National Heath System since there may be a limit to the complexity that a single management body can reasonably supervise.

The variation occurring from different timing of amalgamation reforms across the Italian regions, and then the Italian municipalities, once the effect of sole time is adequately accounted for, provides several advantages to evaluate whether a larger LHA does a better job. In fact, the different time periods of implementation allow for getting rid of potential selection into treatment by keeping in the sample only those municipalities belonging to LHAs that have been treated at some point in the available observation period. Moreover, we are able to control for potential anticipation effect and to disentangle the full dynamics of

the treatment effect in the short and in the medium-long run. Using a staggered difference in difference approach, our findings show that population mortality increased in the years following the reform, especially in mountain municipalities, reasonably the most isolated ones, and suggest that policy makers should carefully consider the impact on health care effectiveness and on accessibility to care before allowing more mergers.

This paper is organized as follows. Section 2 gives the background of the amalgamation process in Italy in our observed period. Section 3 provides the literature framework to which this analysis belongs. In section 4 we discuss the data and the methodology. Section 5 presents the results and section 6 concludes.

2 Institutional changes: the consolidation process

The Italian National Health Service (NHS henceforth) was established in 1978 with the objective of providing uniform and adequate health case throughout the country. Ever since, health care expenditure increased systematically over the years, while life expectancy considerably grew at national level, as depicted in figure 1. The increase of life expectancy and the consequent aging of population, shown in figure 2, raised concerns on the dynamics of health spending.

In order to control such expenditure growth, various subsequent Italian Governments introduced policy reforms such that the institutional features of health care providers remarkably changed over time. With a constitutional reform in 2001, a major process of decentralization invested the National Health Service (NHS hereafter) structures, shifting responsibilities from central state to regions, which achieved a large control and coordination over their LHAs. Each LHA is responsible for organizing, coordinating and providing at least the essential levels of care (*Livelli Essenziali di Assistenza, LEA*) in a specific geographical area, in order to achieve uniform basic level of care on a national basis. The Italian LHAs experienced a drastic reduction of their number, passing from 659 in 1992 to 197 in 2001 (Di Novi *et al.*, 2018), resulting 139 in 2015 and 101 in 2017 (Ministry of Health, 2018). They decreased by almost 85% from 1992 to 2017. As a trivial result, the declining number of LHAs over time provoked an increase in the average population size under the

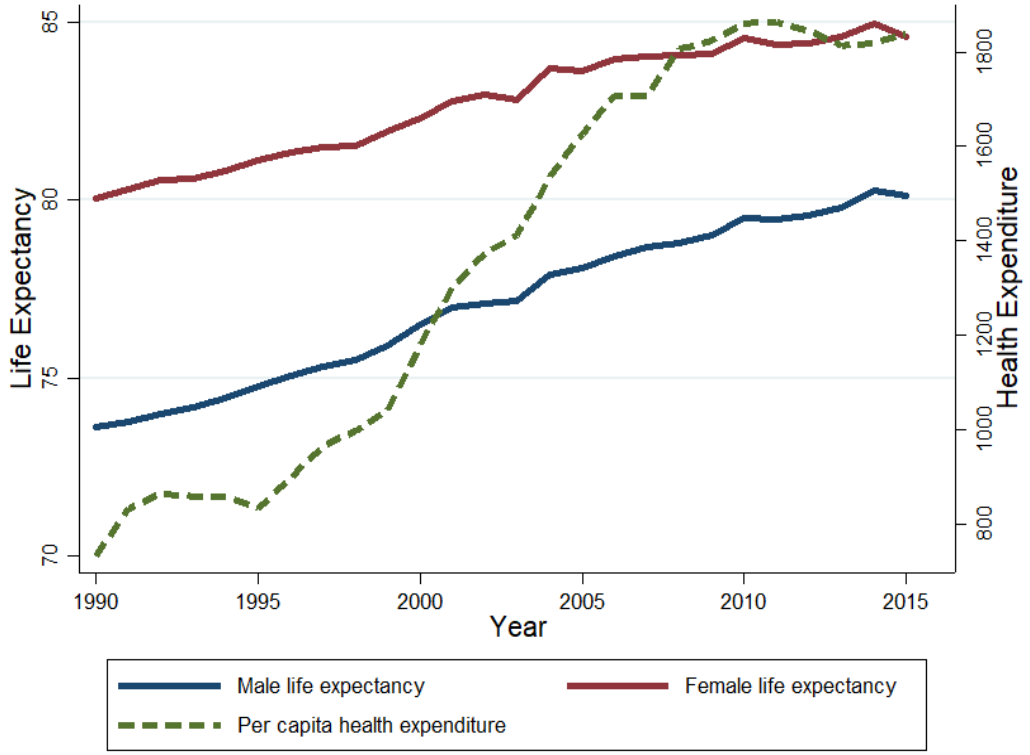

Figure 1: Life expectancy by gender and health expenditure in Italy from 1990.

Source: author graph based on ISTAT data.

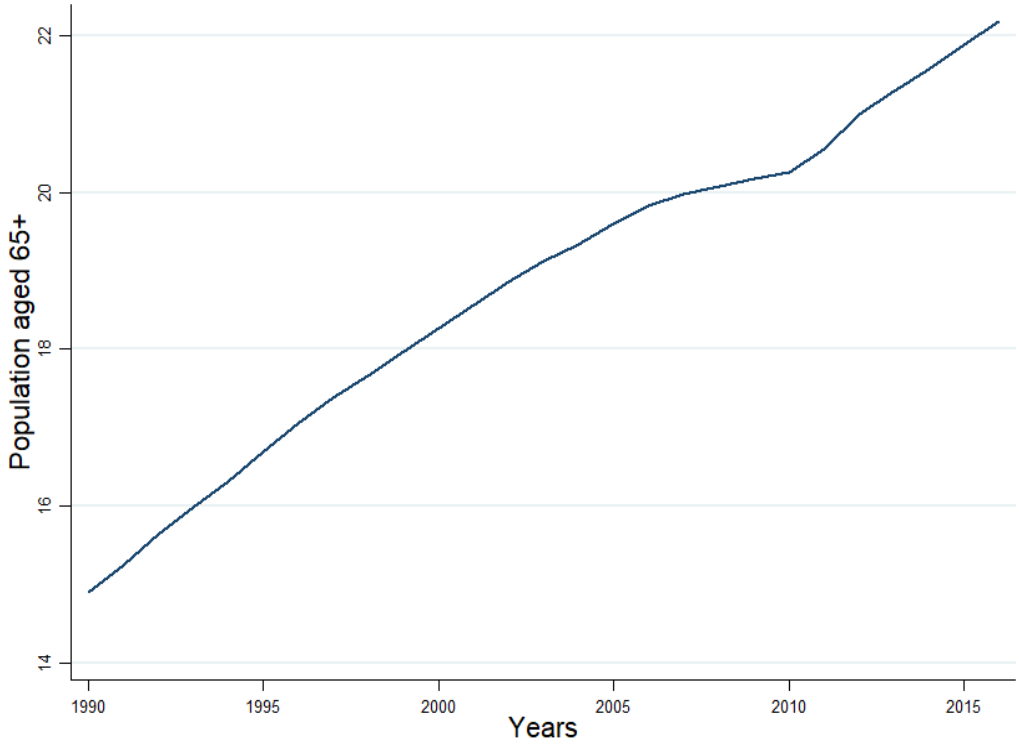

Figure 2: Share of population aged 65 and older in Italy from 1990.

Source: author graph based on ISTAT data.

responsibility of one LHA.

The merging of LHAs seems to belong to policies mostly oriented to contain costs and increase efficiency. Indeed, several studies have documented the presence of regional differentials in Italian public spending in health sector (Francese and Romanelli, 2014). Starting from 2007, the Central Government, in order to avoid financial failure in some regions where emerged significant management deficits in health expenditure, introduced a special regime called "Recovery Plan"(*Piani di Rientro*), aimed at restoring the economic-financial equilibrium of the regions concerned. The merging process seems to be nested in this cost saving-oriented process: in the last wave of merging, from 2001 to 2015, 32 out of 58 LHAs merged are located in regions under Recovery Plan (Di Novi *et al.*, 2018). However, it is worth notice that the merging process does not regard only LHAs with deficit problems but appears a more comprehensive approach involving even the most diligent regions, including Emilia Romangna, Tuscany and Lombardy, such that gained the definition of "merging mania".

Table 1 details the above mentioned Italian LHAs amalgamation process.

Table 1: LHAs amalgamation from 2000 to 2017

Region	**Year of Policy Shift**	**LHAs codes before and after the mergers**[1]
Piedmont	2008	101+102=201; 103+104=202; 105+106+110=203; 107+109=204; 115+116+117=210; 120+121+122=213
A. P. of Bolzano	2007	101 + 102 + 103 + 104 = 201
Emilia Romagna	2004	107+108+105=105
Marche	2006	101+102+103+104+105+106+ +107+108+109+110+111+112+113=201
Abruzzo	2010	101+104=201; 102+103=202
Molise	2006	101+102+103+104=201

[1]The size of those not included remained unchanged. Some LHAs in Veneto and Piedmont experienced a merger in 2017 but, due to the lack of an up-to-date list of Italian hospitals by Ministry of Health for 2017, we are not able to reconstruct the merging design. Sardinia 2017 mergers are instead clear even without detailed information about single hospitals because all LHAs have been merged into only one.

Campania	2009	101+102=201; 104+105=203; 107+108=205; 109+110=206; 111+112+113=207
Apulia	2007	102+103+104+105=114; 107+108+109=115; 110+111=116
Basilicata	2009	101+102+103=201; 104+105=202
Calabria	2008	101+102+103+104=201; 106+107=203; 110+111=205
Calabria	2011	109+205=205
Umbria	2013	101+102=201; 103+204=202
Emilia Romagna	2014	110+111+112+113=114
Friuli V. Giulia	2015	102+105=202
Lombardy	2016	308+309+310+306=321; 314+303=322; 303+313+315=323; 324=305+311; 327=304+307
Tuscany	2016	201=103+104+110+111; 202=101+102+105+106+112; 203=108+107+109
Lazio	2016	201=105+101; 202=102+103
Sardinia	2017	101+102+103+104+105+106+107+108=201

Source: the author, on Ministry of Health data.

3 Literature Review

This paper relates to two different strands of the literature that, in this case, build ties one to another. First, a branch related to the potential cost-minimization effect by means of economies of scale and scope. Second, the debate on the positive effect of higher volume of cases on quality outcomes through knowledge spillover.

To the best of our knowledge, Di Novi, Rizzi and Zanette (2018) is the only study that focused on the Italian LHAs consolidation and studied the potential cost savings arising from the LHAs reconfigurations. They found the presence of economies of scale linked to the size of the LHAs population. Indeed, their estimation highlights an elasticity of administrative per capita costs with respect to population size of -2.50, that becomes -0.112 and -0.127 for goods and non-health-service costs, respectively. Hence, *ceteris paribus*, the smaller the LHA, the higher the per capita non-health-service costs.

Their analysis focused only on administrative costs, cost of goods and non-health-service costs, namely costs not directly involved in the provision of health care, under the assumption that the quantity and the quality of health care provided remained constant. Our study instead tries to relax this assumption and it is aimed at estimating the effect of mergers in terms of health care quality outcomes. Indeed, as Di Novi *et al.* themselves suggested, savings may be an important driver in limiting growing cost of health care and may be used to improve the quality of treatments, for instance, in terms of making more R&D investments.

Furthermore, there is a large body of empirical literature documenting the existence of a positive correlation between the volume of cases treated by a hospital and better health outcomes achieved by patients. Mortality appears lower in those hospitals that perform more times a given procedure. The leading explanation for this positive correlation is the "practice makes perfect" effect. More specifically, larger hospitals may be able to provide better quality of treatments and then to achieve better outcomes for their patients through learning-by-doing or quality enhancing scale economies (Luft et al., 1987, Gaynor et al., 2005, Cavalieri *et al.*, 2013). This direction of causality from volume to better outcomes matters for policy, supporting the idea of centralization of procedures in a few hospitals and, eventually, the mergers policies. What is not trivial in this picture is to shed light on the temporal pattern the characterizes the positive correlation between volume and outcomes. In particular, Gaynor *et al.* (2005), examined the relationship between volume and outcome for a type of heart surgery, the coronary artery bypass graft (CABG), questioning whether the effect is only contemporaneous and due to static-scale-economies or could be inlaid in

the framework of learning models, namely via lags with a more complicated dynamics. Their results coming from a probit model estimation suggest that the volume-outcome effect is mainly contemporaneous albeit there is not sufficient variation in their data to robustly identify the lags dynamics.

Our analysis is also akin under certain aspects to another interesting study made by Gaynor*et al.*(2012). They contributed to the recent literature on the merging mania of public service providers examining the impact of a wave of general hospitals mergers in England between 1997 and 2006 on a large list of hospital performance outcomes including clinical quality, productivity, waiting times and financial performance. Since the policy shift occurred in different years across hospitals, they used an extended Difference in Difference approach, also called "event study", where the treatment date is the date of merger and the control group is selected through a matching procedure among those hospitals that never merged that are similar in terms of observable characteristics. They studied the impact on above mentioned outcomes two years prior to the year of the merging approval, controlling also for potential anticipation effects, and four years after, in order to disentangle the full dynamics of the impact in the medium run and not only considering the immediate post reform treatment effect. Their results are not reassuring: despite hospital admissions and staff size fell after the merger, quality measures remained unchanged, productivity did not increased while financial deficits and waiting times did.

4 Identification Strategy and Data

In this paper, we aim at evaluating the impact of the Italian LHAs amalgamation program on the population mortality within municipalities. The major sources of our data are the Italian National Statistical Institute (ISTAT), the Ministry of Health (MH) and the Ministry of Economy and Finance (MEF).

We collected data for any Italian municipality from 2002 to 2016 with respect to these variables of interest: population mortality, population size, population stratification by age, pre-tax fiscal income, regions under recovery plan and natural disasters. Then we reconstructed the LHAs reconfiguration by means of the yearly-based databases released by the

Ministry of Health including the comprehensive list of the whole population of Italian hospitals and the LHAs to which they belong, and the LHAs-municipalities correspondence. Following the correspondence among any single hospital and its LHA over the years, we were able to precisely identify the LHAs mergers since our data-driven method showed a perfect aggregation of all hospitals belonging to separated LHAs to only one LHA. In other words, the available administrative data assure the absence of a chaotic amalgamation process where, for instance, only a share of hospitals belonging to a LHA ended up under the responsibility of a bigger one resulting after the merger. The consolidation was instead much simpler and could be summed up as the aggregation of all the hospital belonging to two or more LHAs in one bigger one, as table 1 showed in the previous section.

Once we gained a clear picture of the consolidation process, distinguishing between treated and untreated municipalities, namely municipalities belonging or not belonging to a merged LHA, was straightforward given the correspondence LHAs-Municipalities issued by the Ministry of Health.

Table 2 recaps a brief description of the data, the sources and the main descriptive statistics.

Since each region set up the policy in different years, as outlined in Table 1, we use a staggered difference in difference as identification strategy to estimate the average treatment effect. More precisely, we standardized the time dimension as $m = -5$ periods before and $n = +12$ periods after the treatment. We then have a certain time window around the adoption of the policy $(-5, -4-3, -2, -1, 0, 1, 2, 3, ..., 12)$ where 0 is the last pre-treatment period. This is similar to the approach undertaken by Stevenson and Wolfer (2006) and, more recently, by Gippet *et al.* (2015). We estimate the following equation:

$$y_{it} = \alpha_i + \delta_t + \alpha_i * t + \sum_{k=m}^{n} \gamma_k D_{it} + \phi X'_{it} + \epsilon_{it}$$

Where y_{it} is the mortality rate for municipality i at time t, α_i are the municipalities fixed effects and δ_t the year fixed effects, $\alpha_i * t$ the municipality-specific trends, D_{it} is a vector of time effects relative to time from $t = -5$ to $t = +12$ and X'_{it} is a set of confounders such as income, population size and stratification, recovery plan regime and the occurrence of

Table 2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N	Source
Mortality rate (%)	1.058	0.523	0	9.090	101311	ISTAT
Population aged 55 and older(%)	34.154	6.761	9.492	81.818	101576	ISTAT
Per capita income (thousands)	10.216	3.284	1.562	52.904	100989	MEF
Natural disasters	0.009	0.092	0	1	103187	EU and Italian Civil Protection
Population (thousands)	7.636	28.084	0.031	1345.851	101576	ISTAT
Recovery Plan	0.24	0.427	0	1	101590	Bank of Italy
5-4-3 years before (the baseline)	0.312	0.463	0	1	38529	Our elaboration on MH data
2-1 years before	0.216	0.412	0	1	38529	Our elaboration on MH data
1-2 years later	0.135	0.342	0	1	38529	Our elaboration on MH data
3-4 years later	0.099	0.299	0	1	38529	Our elaboration on MH data
5-6 years later	0.093	0.29	0	1	38529	Our elaboration on MH data
>6 years later	0.145	0.352	0	1	38529	Our elaboration on MH data

Source: the author

natural disasters. Note that our dependent variable, y_{it}, is the mortality rate of all people residing in the municipality i at time t, not just those admitted to an hospital that received health care goods.

We analyze this dimension of mortality to avoid potential endogeneity problems posed by the possibility that hospitalization decisions, namely seeking structured care in an hospital, may responds to quality of provided care regime. First, patient mobility among hospitals may incentive the more severe cases to move to better perceived hospitals, whose case mix index would increase and the worse off outcomes in terms of patients mortality may not depend to a lower quality of care but to an increased complexity of treated cases. Second, if an individual experiences a lack of trust in the quality of hospital care provided by its LHA, he may postpone the treatment as far as he could, causing a worsening of the disease, and in the extreme case, deny to cure himself.

Since we have panel data, we attempt to control for unobservable factors by including municipality fixed effect and time fixed effect. Municipality fixed effects eliminate any confounding factor, observed or unobserved, that is constant over time within each municipality. Year fixed effects eliminates any confounding factor, observed or unobserved, that is constant across all municipalities within each year. Second, since we have data for several years, we control for municipality-specific trends. Further, the relatively long period of our dataset, allows us to get rid of selection into treatment, as LHAs subject to mergers may be not randomly selected. As suggested by Gaynor *et al.* (2012), a good candidate for the control group in such analysis could be constructed with all the units that are not treated at time t but that will merge in future years. With this aim we keep in our dataset only those 4163 municipalities belonging to LHAs that merge at some point in our observed time-span.

In addition, we are able to capture and disentangle the full dynamic response of the mortality rate to the institutional change by evaluating the effect for each year following the adoption of the amalgamation reform. This approach not only gives us a deeper insight on the policy effect over time, which could be heterogeneous over the years, but also allow for potential anticipation effects by looking at the municipality mortality one and two years before the reform approval. We also believe that in an analysis based on population mortality

as outcome of interest, time dummies and time trends are not redundant. Indeed, there is a potential long-term linear trend of the outcome in time and it could be also subject to periodic macroeconomic shocks that are large enough to affect it. The standard errors are clustered by municipality as our observations are non-independent since we have multiple observations for the same unit (municipality).

5 Results

Table 3 shows the results for three different sample of municipalities: column one refers to the population mortality for all municipalities, regardless their geographical characteristics, column two and three distinguish between mountain municipalities (2) and non-mountain municipalities (3). Findings show that there is statistically significant increase in municipality mortality after the reform and this effect grows over time with respect to the baseline pre-reform years (3, 4 and 5 years before). In fact, the coefficients for the post-reform dummies are always positive and significant, increasing from 0.029 immediately succeeding the reform, to 0.144 after more than 6 years. Given that the mortality rate may range between 0 and 100, with a sample average of 1.058, the estimated coefficients can be readily interpreted in terms of increased mortality rate. They imply that, being in the post-reform years (a unit increase in the associated indicator), would increase the population mortality by 2.7% in the two periods after the policy shift with respect to the baseline pre-reform years, 6.8% in the third and four year following the LHAs consolidation, 10.4% in the the fifth and the sixth, 13.6% after more than six years. Interestingly, the effect is produced in both types of municipalities considered, mountain and non-mountain, but it is worth noticing that its magnitude looks almost double in the mountain municipalities in the medium-long run. The non-statistically significance of the coefficient associated to the time dummy 2-1 years before suggests that no anticipation effect occurred. The aging of population seems to be positively correlated to mortality, as expected, likewise the recovery plan regime. The negative sign of the per capita income confirms the positive association between health and wealth suggested by the related literature.

Table 3: Estimation results

Variable	(1) All municipalities	(2) Mountain	(3) Non-mountain
	Coefficient	Coefficient	Coefficient
	(Std. Err.)	(Std. Err.)	(Std. Err.)
Population	0.006	0.284***	0.001
	(0.004)	(0.062)	(0.001)
Population aged 55 and older	0.079***	0.089***	0.068***
	(0.007)	(0.009)	(0.008)
Per capita income	-0.027***	-0.048***	-0.012
	(0.010)	(0.016)	(0.010)
Recovery Plan	0.036***	0.010	0.041***
	(0.012)	(0.025)	(0.012)
Natural disaster	-0.033	-0.047	0.028
	(0.027)	(0.034)	(0.048)
2-1 years before	0.014	0.016	0.008
	(0.009)	(0.016)	(0.009)
1-2 years later	0.029**	0.019	0.035**
	(0.014)	(0.024)	(0.016)
3-4 years later	0.072***	0.055*	0.067***
	(0.020)	(0.033)	(0.021)
5-6 years later	0.110***	0.106***	0.065**
	(0.024)	(0.040)	(0.025)
>6 years later	0.144***	0.148***	0.087***
	(0.030)	(0.051)	(0.030)
Municipality fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Municipality-specific linear trend	Yes	Yes	Yes
N	38229	17659	16331
R^2	0.734	0.689	0.797
F	18.086	13.337	11.777

Notes: robust standard errors in parentheses, clustered at municipality level. *** p<0.01, ** p<0.05, * p<0.1. Dependent variable is the municipality population mortality rate by year. The baseline pre-reform dummy, obtained by aggregating the fifth, the fourth and the third year preceding the consolidation policy, is omitted.

6 Conclusions

This paper investigates the impact of Local Health Authorities consolidation process on population mortality within Italian municipalities from 2002 to 2016, aiming at providing some evidence on potential indirect effects produced by the recent "merging mania" that has characterized the Italian institutional settings. Since each region set up the policy in different years, we use a staggered difference in difference as identification strategy to estimate the average treatment effect, disentangling the full dynamics both in the short run and in the medium-long run. We estimate the impact of these policy shifts on population mortality using the within municipality variation over time, distinguishing between the geographical characteristics of municipalities (mountain Vs. non-mountain) and controlling for individual municipality trends. Our findings show that population mortality increased by 2.7% in the two periods after the reform, by 6.8% in the third and fourth year following the LHAs consolidation, by 10.4% in the the fifth and the sixth, by 13.6% after more than six years. We therefore conclude that policy makers should carefully consider the impact on health care quality and effectiveness before allowing more mergers.

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