Does fiscal decentralization affect regional disparities in health? Evidence from an Italian tax reform

Cinzia DI NOVI [*] [§]

Massimiliano PIACENZA [+] [#] [§]

Silvana ROBONE [†] [ε] [§]

Gilberto TURATI [°] [§]

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Abstract

We test the effects of fiscal decentralization on health inequalities identifying the impact of an exogenous tax reform aimed at increasing regional tax autonomy, which was implemented in Italy at the end of the Nineties. Exploiting stark differences across regions in the size of own tax bases, we find that fiscal decentralization – besides reducing inefficiencies of healthcare policies – affects also within-regional disparities in health outcomes. However, the effect of the reform on health inequalities rests on the degree of economic development, which affects both the actual fiscal autonomy of regions and their ability to define effective health policies. Findings are robust to a number of alternative stories.

JEL codes: H75, I14, I15, I18, R50.

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[*] University of Pavia – Dept. of Economics and Management, Via San Felice 5, 27100 Pavia, Italy. E-mail: cinzia.dinovi@unipv.it.

[§] Health Econometrics and Data Group (HEDG), University of York, Alcuin Building, Heslington, YO10 5DD, York, UK.

[+] **Corresponding Author**: University of Torino – Dept. of Economics and Statistics (ESOMAS), Corso Unione Sovietica 218 bis, 10134 Torino, Italy. E-mail: massimiliano.piacenza@unito.it.

[#] Italian National Research Council – Research Institute on Sustainable Economic Growth (CNR-IRCrES), Via Real Collegio 30, 10024 Moncalieri (TO), Italy.

[†] University of Insubria – Dept. of Economics, via Monte Generoso 71, 21100 Varese, Italy. E-mail: silvana.robone@uninsubria.it.

[ε] Bocconi University – Dondena Centre for Research on Social Dynamics and Public Policy, via Roentgen 1, 20136 Milano, Italy

[°] Catholic University – Dept. of Economics and Finance, Largo Francesco Vito 1, 00168 Roma, Italy. E-mail: gilberto.turati@unicatt.it.

1. Introduction

Over the last forty years a decentralization wave has swept the world and, nowadays, devolution still ranks high in the policy agenda of many developed as well as developing countries (e.g., World Bank, 1997, 2017; Bird et al., 1997; OECD, 1997; Joumard and Kongsrud, 2003). While the transfer of powers and resources to sub-national tiers of government has been traditionally justified on identity grounds (e.g., De Winter and Tursan, 1998; Moreno, 2001), the more recent wave of devolution has been vindicated on the argument of a supposed greater ability of sub-national governments to overcome the failures of the centralized state and to deliver improved economic efficiency (e.g., Bardhan, 2002; Weingast, 2009). Critics, however, point out that decentralization can lead to an increase in both the size and the number of bureaucracies (e.g., Reverte-Cejudo and Sánchez-Bayle, 1999; Repullo, 2007), and to an uneven geographical distribution of benefits (e.g., Martınez-Vazquez and McNab, 2003). This distributional issue is particularly relevant in contexts characterized by stark geographical differences in terms of economic development. Empirical evidence produced so far is mixed: decentralization can be associated to a reduction (e.g., McKinnon, 1997; Qian and Weingast, 1997; Shankar and Shah, 2003; Gil et al., 2004) or to an increase in geographical disparities (e.g., Cheshire and Gordon, 1998) – or to both – depending on country-specific factors, such as the degree of development, the pre-existing level of territorial inequalities, and the fiscal redistributive capacity of countries (Rodriguez-Poze and Ezcurra, 2010).

Health care policies are among those most commonly decentralized, even in unitary states (e.g.; Costa-Font and Greer, 2013; Anton et al., 2014); and the Italian National Health Service (NHS) does not constitute an exception. The NHS was established in 1978 in order to replace the previous system based on insurance funds, with the declared goal of providing *uniform* and comprehensive healthcare services across the country. However, as healthcare expenditure increased steadily over time, the central government introduced reforms aimed at capping spending growth, shifting the responsibility of both management and funding from central government to regional jurisdictions. The aim of these reforms was to improve spending efficiency by increasing regional governments' accountability via fiscal autonomy (e.g., Bordignon and Turati, 2009; Ferrario and Zanardi, 2011; Piacenza and Turati, 2014). However, some scholars doubt on the consequences of decentralization, which – despite improving efficiency – might have sharpened the existing differences in the quality of care across regions: the more fiscally autonomous regions (those with the better

ex-ante quality of care) can spend more after devolution, by exploiting substantial tax bases; as a consequence, between-regional inequalities might increase. However, this argument does not take into account that in Italy, as in other countries, fiscal decentralization has come together with equalization grants and constitutional rules of uniform provision of a quasi-universal set of services across the country (e.g., Costa-Font and Turati, 2016). Therefore, in the years immediately after devolution, the *level* of funding for regions (even the poorest) did not substantially change; what did change is the *composition* of funding, the more so in more rich and fiscally autonomous regions.

What are the consequences on health disparities of increasing the share of own taxes on total revenues? The goal of the paper is to provide an answer to this question, by assessing the impact of fiscal decentralization of health care funding on between-regional and within-regional disparities in self-assessed health. In particular, we exploit a tax reform that increased fiscal autonomy of Italian regions since 1998: the regional setting of the Italian NHS and the wide variation in the size of the tax bases offer a unique opportunity to this end. Our main finding suggests that decentralization – besides improving efficiency in more fiscally autonomous regions – also helped contain health disparities more within those same regions, in a period in which within-regional health inequalities were on the rise. According to our estimates, *ceteris paribus*, the inequality index has been contained on average about 4 times its standard deviation, with much stronger effects in richer (Northern) regions compared to poorer (Southern) ones. This result has been obtained without any remarkable effect on between-regional health disparities and without deteriorating average perceived health.

Our work is related to the growing literature studying the impact of health care decentralization on a variety of health outcomes, which provides empirical results often mixed and inconclusive (e.g., Jepsson and Okuonzi, 2000; Tang and Bloom, 2000; Bossert et al., 2003; Akin et al., 2005; Arreondo et al., 2005; Kolehmainen-Aitken, 2005; Saltman et al., 2007). As far as the Italian NHS is concerned, most works have focused on the relationship between decentralization and the efficiency of health policies (e.g., Bordignon and Turati, 2009; Piacenza and Turati, 2014; Francese et al., 2014; Cavalieri and Ferrante, 2016). This literature provides support to modern fiscal federalism theories, according to which fiscal decentralization makes local governments more accountable and efficient. As for the impact on inequalities, studies available so far have discussed the *between-regional* dimension of

disparities, finding mixed evidence on the impact of decentralization (e.g., De Belvis, 2012; Toth, 2014; Blöchliger et al., 2016; Costa-Font and Turati, 2016).

The remainder of the paper is organized as follows. Section 2 provides essential background information on the decentralization reform. Section 3 provides descriptive evidence on the impact of the reform on the outcome of interest. Section 4 presents the empirical strategy. Estimates are discussed in section 5, while section 6 provides brief concluding remarks.

2. Institutional background: the decentralization reform

According to independent reviewers, the Italian health care system is one of the best performers at the global level.[1] However, this good performance at the national level hides important differences across Regions (which are the level of government in charge of managing health care according to the Republican Constitution), with a clear gradient moving from the North to the South of the country (e.g., Turati, 2014).[2] For instance, considering ISTAT-*Health for All* data, the infant mortality rate ranged from 18.89 in the Aosta Valley to 47.32 in Calabria in the most recent available year (2013). The gradient is also apparent looking at income: as is well known, the Italian *Mezzogiorno* is poorer than the Northern part of the country, with clear consequences in terms of the availability of tax bases.

The persistent uneven distribution of income across Regions had dramatic consequences when – during the Nineties – the central government reformed the NHS funding. The main motivation behind the reform was to improve efficiency in spending in order to meet the criteria defined by the European Treaties for public finance. To pursue this aim, in 1998 the central government introduced two new autonomous sources of revenue for Regions, both characterized by a tax base closely correlated to regional GDP: a new regional tax, IRAP (literally a Tax on Regional Firms' Value Added), together with a regional surcharge on the Personal Income Tax (IRPEF). As in other unitary countries, the reform was completed in 1999 by the constitutional provision of uniform levels of care to be guaranteed by the central government in all regions, via a system of equalization grants. Hence, as transfers from the centre were cut correspondingly to the increase in autonomous

[1] See, e.g., http://www.bloomberg.com/infographics/2014-09-15/most-efficient-health-care-around-the-world.html.

[2] Regions are the level of government directly below the central government, and above provinces and municipalities. There are 20 Regions in Italy, very different in terms for instance of size, population, and per-capita GDP.

revenue for all regions, the reform did not modify the whole amount of resources devoted to health, both overall and for each region, but changed the *composition* of revenues differently for different regions, according to the tax base available in each constituency.

According to modern fiscal federalism theories (e.g., Weingast, 2009), the more sub-national government are fiscally autonomous, the higher their accountability. In the Italian case, since the tax bases of the two new regional taxes are positively related to GDP and income is unevenly distributed across regions, also uneven was the impact of the decentralization reform on fiscal autonomy and the composition of revenues. In particular, Northern regions experienced a larger reduction of transfers with respect to Southern regions, that continued to mostly rely on grants from the centre to fund healthcare spending. To understand the magnitude of the differences, after the tax reform IRAP, IRPEF surcharge and other own taxes represent about half of revenues in richer Centre-Northern Regions, while they are a mere 15% in poorer Southern ones (e.g., Turati, 2014). According to theory, consequences on the efficiency in managing health spending were estimated to be also differentiated across regions, with Northern regions becoming even more efficient than Southern ones (Bordignon and Turati, 2009; Piacenza and Turati, 2014). What we do in this paper is to explore the impact stemming from increasing fiscal autonomy on health inequalities.

3. Data and preliminary descriptive evidence

We use individual-level data drawn from the 1994–2007 cross-sectional survey "*Indagine Multiscopo sulle Famiglie – Aspetti della Vita Quotidiana*" carried out yearly by the Italian Institute of Statistics (ISTAT) to build regional measures of inequality.[3] The survey encompasses a representative sample of 20,000 Italian households (60,000 individuals) living all over Italy.[4] We limit our analysis to over 16 years old subjects living in one of the 19 regions (data from Aosta Valley and Piedmont have been collapsed into a unique regional unit by ISTAT).

Self-assessed health (SAH) is our indicator for general health. SAH has been widely used in the literature examining the relationship between health, socio-economic status and life-styles (e.g., Kenkel, 1994; Contoyannis and Jones, 2004; Balia and Jones, 2008).

[3] Data concerning 2004 are not included in the analysis since the Multiscopo survey did not take place in 2004. We also do not consider data after 2007 because of a change in the wording of the question on self-assessed health in 2008.

[4] Individual weights provided by ISTAT were applied in all computations, in order to make the results representative of the Italian population.

Moreover, SAH has been shown to be a good predictor of mortality or morbidity (e.g., Idler and Beyamini, 1997; Kennedy et al., 1998) and to have a strong correlation with more complex health and well-being indices (e.g., Unden and Elofosson, 2006). As in other similar surveys around the world, respondents have been asked the following question: "Would you say that in general your health is: very bad (1), bad (2), fair (3), good (4), very good (5)".[5] SAH is clearly measured on an ordinal and categorical scale, and it requires appropriate tools for the analysis.

Variable	DECENTR = 0 1994-1997	DECENTR = 1 1998-2007	t-test of the difference (p-value)
Average "median SAH"	4.57	4.34	0.004
CV of "median SAH"	0.11	0.11	0.256
Average % "good"/"very good"	0.77	0.76	0.032
CV of % "good"/"very good"	0.04	0.03	0.004
Average of per capita public health exp. (€)	900	1387	0.006
CV of per capita public health exp.	0.10	0.08	0.003

Table 1. Average and coefficient of variation (CV) across Regions of health outcomes and per capita public health expenditure in the years before and after the reform

We begin our analysis from *between-regional* inequality. Table 1 shows some descriptive statistics on the evolution of SAH across all regions, before (1994-1997) and after (1998-2007) the fiscal decentralization reform. For both the median value of SAH and the percentage of individuals responding having "good" and "very good" health, we compute the average and the coefficient of variation (CV) across regions for the two sub-periods.

[5] Notice that when individuals are faced with an instrument comprising ordinal response categories, their interpretation of response categories may systematically differ across populations or populations sub-groups, also depending on their preferences and norms (Bago d'Uva et al., 2008; Rice et al., 2012). In such cases a given level of health is unlikely to be rated equally by all respondents. This phenomenon has been termed "reporting heterogeneity". In order to check that reporting heterogeneity is not a relevant issue for our analysis, we have computed the level of correlation between self-reported health and a more objective indicator of health, constructed through responses to fairly precise questions about specific health conditions. To build this summary measure, we use the number of health conditions reported by the respondents during the interview (heart problems, high blood pressure, high cholesterol, stroke, diabetes, lung disease, asthma, arthritis, osteoporosis, cancer, ulcer, Parkinson disease, cataracts, hip or femoral fracture, psychological problems). For each year, we run an ordered probit regression model in which the independent variable is SAH and the dependent variable is the summary indicator of health conditions. The adjusted R^2 of the model tends to be constant and equal to about 15% for all years. Hence, SAH appears as strongly predictive of the summary health index. Moreover, the results of a chi-square test shows a large and statistically significant correlation between the two variables, since, for each year, their correlation coefficients tend to be constant and equal to about 60%.

Even if the difference is statistically significant, both measures do not show substantial changes over time. More important, the between-regional disparities in health outcomes (as measured by CV) did not change (median SAH) or even slightly decreased (% "good"/"very good"). This evidence confirms the view that the tax decentralization reform has not exacerbated health disparities *between* regions, largely because a system of equalization grants was implemented (e.g., Costa-Font and Turati, 2016). It is also worth noticing that the average per capita public health expenditure significantly increased of roughly 500 euro after the reform, while the coefficient of variation across regions slightly decreased, thus revealing a reduction in between-regional disparities in health spending.

Turning to *within-regional* variation in SAH, we make use of the innovative inequality index developed by Kobus and Milos (2012), a generalization of the Abul Naga and Yalcin (2008) index. The KM inequality index is "median based" (and not "mean based" as the more traditional inequality indexes) and lies in the interval [0, 1]. The average value of the KM index (computed using symmetric weights for inequalities below and above the median) across regions and years is about 0.4 (Table 2), relatively high in comparison to other European countries studied in the still limited literature using median-based inequality indexes. For instance, Abul Naga and Yalcin (2008) estimated an average level of inequality in self-assessed health across seven regions in Switzerland of 0.208. Madden (2010) reported an inequality index in SAH ranging from 0.356 in 2003 to 0.333 in 2006 for Ireland. Figures 1a-1b illustrate the evolution of the inequality index over the period 1994-2007 for "poor" Italian regions (with GDP per-capita below the median, the less fiscally autonomous, Figure 1a) and for "rich" regions (with GDP per-capita above the median, the more fiscally autonomous, Figure 1b). Despite it is difficult to gauge a common pattern, health inequalities in the first group of regions (the Southern ones) seems to have increased after the fiscal decentralization reform, whereas inequality in the second group of regions (the Northern ones) appears relatively stable across the whole period. One can then expect an inequality reducing impact associated with a higher fiscal autonomy, which we aim at identifying with a formal econometric model.

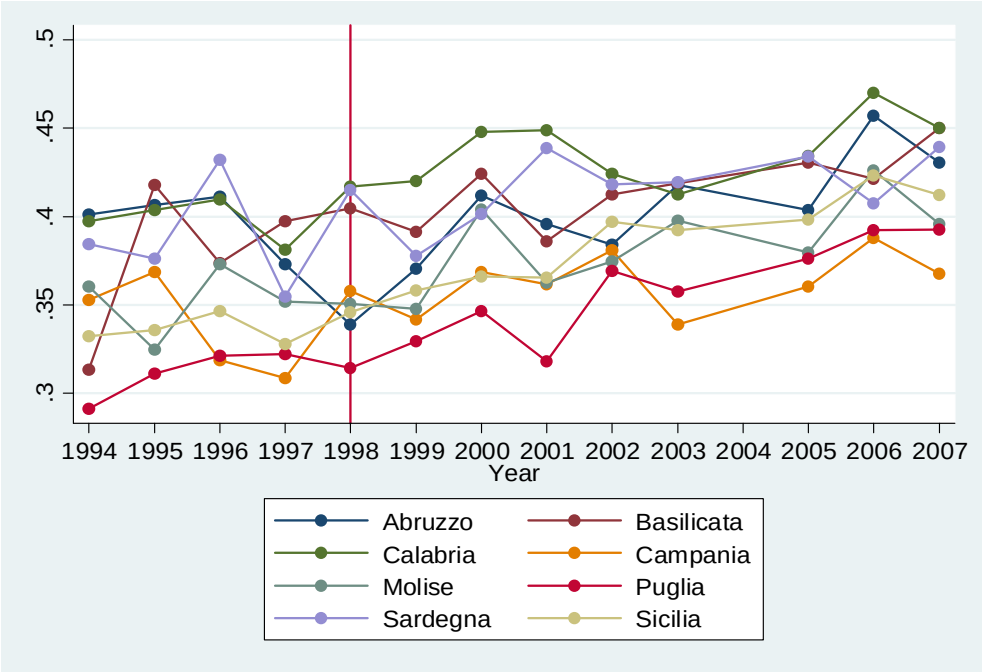

Figure 1a. KM index in low-GDP Regions, by Region and year

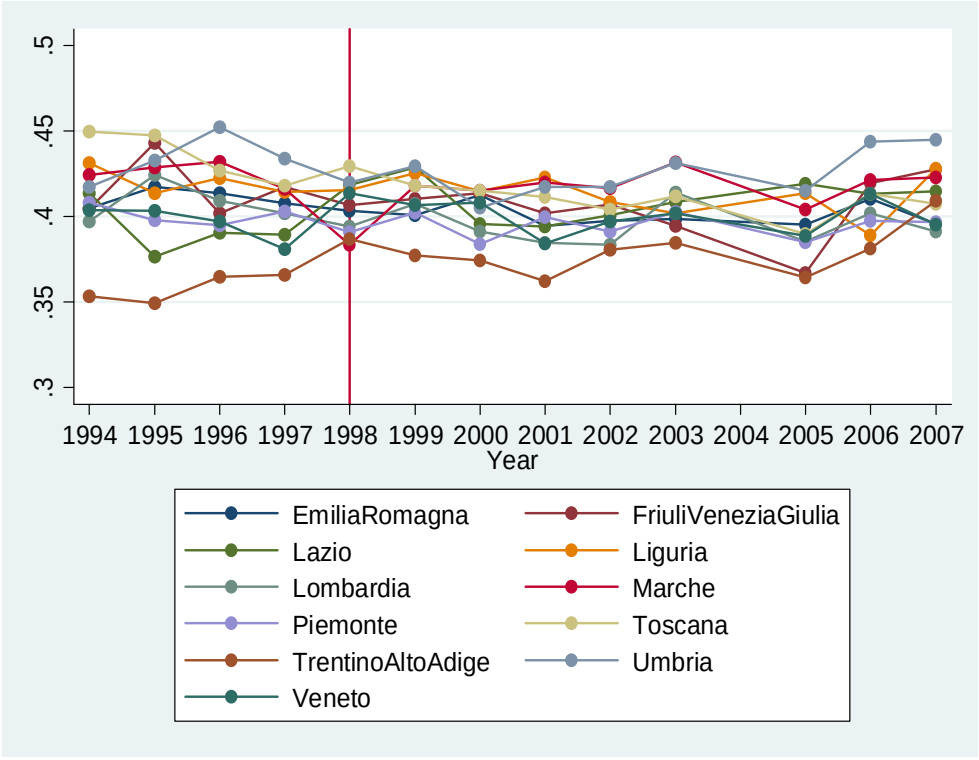

Figure 1b. KM index in high-GDP Regions, by Region and year

4. The empirical strategy

4.1. Identification

In order to investigate the impact of the fiscal decentralization reform on *within-regional* health inequalities measured by the KM index, we exploit the differences in the level of income across the Italian regions. As a consequence of the reform, these differences in income originate differences in the exposure to treatment, since regions characterized by a higher per-capita income (hence, a higher tax base) have become more fiscally autonomous than regions with a lower per-capita income. Adopting a *multivalued treatment* approach (e.g., Imbens and Wooldridge, 2009), we estimate the following general model specification:

$$KM_{it} = R_i + T_t + \beta GDP_{it} \times DECENTR_t + \delta X_{it} + \varepsilon_{it} \quad [1]$$

where KM_{it} is our outcome variable in Region i at time t; R_i denotes a full set of region-specific effects, T_t denotes a full set of year-specific effects, X_{it} is a vector of controls, and ε_{it} is a disturbance term. Standard errors are robust, clustered at the regional level to capture potential serial correlation in the residual error term, in all estimated models.

The average causal impact of the tax decentralization reform is captured by the coefficient β on the interaction term $GDP_{it} \times DECENTR_t$, where $DECENTR_t$ is a dummy equal to 0 in the pre-reform period and equal to 1 from 1998 onwards. Since the tax bases of the two new autonomous sources of revenue are strongly linked to regional per-capita GDP, this variable allows us to capture the different exposure to treatment following the reform, distinguishing regions where the treatment was stronger (those with the highest GDP) from those where the treatment was weaker (the poorest).

A key assumption for our strategy is that the outcomes in regions differently exposed to treatment follow the same trend before the reform kicks in. To test the common trend assumption, we include in the model anticipatory effects (or *leads*) of the treatment. Like in an event study, we also consider post-treatment effects (or *lags*) to test whether the effect of the reform was delayed over time (e.g., Autor, 2003; Acemoglu et al., 2011).

4.2. Confounding factors

The vector of controls X_{it} in equation [1] includes several confounding factors which may vary both across regions and over time. In particular, we consider two main groups of covariates: a) indexes of within-regional inequality in healthcare services utilization and in

healthy lifestyles; b) regional demographic and socio-economic characteristics. Inequalities in both healthcare utilization and lifestyles have been recognized as important determinants of inequality in health (e.g., Mackenbach, 2012, 2014). To build suitable inequality indexes, we exploit additional information provided by the ISTAT *Multiscopo* survey. In particular, looking first at inequality in services utilization, we consider four dimensions: inequality in home care (*inequality_home_care*), inequality in emergency care (*inequality_emergency_care*), inequality in inpatient care (*inequality_inpatient_care*), and inequality in contacts with Local Health Authority to schedule appointments for outpatient visits, blood tests or other laboratory tests (*inequality_contacts_LHA*). Since the variables measuring healthcare access are dummies indicating whether or not the respondent utilized any services during the year of the interview, we use the concentration index proposed by Erreygers (2009), which corrects the standard concentration index defined by Wagstaff et al. (1991) and Wagstaff and Van Doorslaer (2000)[6]. The range of the Erreygers index $E(y)$ is $[-1, 1]$. A negative (positive) value indicates a pro-poor (pro-rich) inequality; a value of 0 indicates that healthcare access is perfectly equally distributed among the population. Since we are interested in the magnitude of need-adjusted horizontal inequality in healthcare access, we employ the absolute value of all indexes. Moreover, we standardize utilization considering need factors related to the individuals' health status (age, gender, self-assessed health, health conditions), social characteristics (education and marital status), enabling/disabling factors (private health insurance, employment status, wealth, difficulties in accessing healthcare services due to distance, monetary costs, or waiting times).

Although the role of the access to healthcare services in addressing health inequality is widely recognized, there is an additional concern about rising inequalities in lifestyles (e.g., Costa-Font et al, 2014; Mackenbach, 2014; Vallejo-Torres et al., 2014). While there exists a substantial literature that shows that a healthier lifestyle is one of the driving factor for good health (e.g., Contoyannis and Jones, 2004; Balia and Jones, 2008; Di Novi, 2010), little is known about the potential influence that these inequalities in lifestyles may have on

[6] Notice that, differently from the standard concentration index, the Erreygers index does not depend on the mean of health, healthcare and health-related behavior variables. This makes it possible to compare regions with different averages. Moreover, while the standard concentration index may give conflicting information when applied separately to health and ill-health, the Erreygers index satisfies the so called ''mirror property'', namely inequalities in health ''mirrors'' those in ill-health (Erreygers et al., 2012; Costa-Font et al., 2014). Further notice that, since straightforward numeric measures of wealth such as household income are not available in the ISTAT survey, we have to use other proxies for the household wealth. In particular, we exploit information about assets ownership and living standards collected during the interviews to build a one-dimensional index of wealth using the Principal Component Analysis (PCA), under the assumption that wealth is reflected in the assets owned and in the living conditions within a household. For a detailed discussion of how to construct asset indices see Vyas and Kumaranayake (2006).

health inequality. In our study we consider an index for inequality in diet (*inequality_diet*) and an index for inequality in smoking *(inequality_smoke*). As a measure of diet, we use a binary variable that takes value one if the respondent does not eat breakfast nearly every day and zero otherwise.[7] To measure smoking behavior we also employ a binary variable that takes value one if the respondent is currently a smoker and zero otherwise. Following Costa-Font et al. (2014), to account for the bounded nature of the health-related behavior variables (between 0 and 1), we apply again the Erreygers (2009) index and, in order to have a measure of lifestyle inequalities reflecting only non-demographic differences, we use the indirect method of standardization discussed above. Finally, since we are interested in the magnitude of inequality in unhealthy habits only, regardless of the sign (pro-poor or pro-rich), in the final regression model we include the absolute value of the two horizontal inequality indexes in unhealthy lifestyles as before. Table 2 shows that inequality in healthcare access are pro-poor and close to zero, except for inequality in contacts with Local Health Authority to schedule appointments, which tends to be pro-rich. Looking at the dynamics of the indexes during the observed period, inequalities tend to increase over time, especially for regions with GDP per-capita below the median, which generally present greater inequality in healthcare access even when pro-poor.[8] Consistently with the previous literature, also inequalities in unhealthy lifestyles appear to be concentrated among the poor and tend to be higher in poorer regions over time.

Demographic and socio-economic characteristics at the regional level and summary information on regional health policies are other important variables which may influence the inequality in health status and have been therefore included in X_{it}. To control for these factors, we use data at the regional level from the ISTAT "*Health for All - Italy*" database. In particular, in our econometric model we control for variables capturing: demographic characteristics of the regional population, like the percentage of individuals older than 65 (*population_over65*) and the percentage of foreigners (*population_foreign*); the level of disposable income (serving also as a proxy for private health spending, which is likely to suffer of an endogeneity problem), like the percentage of low educated individuals (*population_primaryedu*, the share of population with no educational certificates or with only a primary school certificate according to ISCED classification) and the employment rate

[7] Belloc and Breslow (1972) in their epidemiological study based on the Alameda County survey carried out in California in 1965, found that people who eat breakfast almost every day reported better overall physical health status than breakfast skippers.

[8] Descriptive statistics for inequality indexes disaggregated by years and Regions are not reported for sake of brevity but are available on request.

(*population_employment,* the share of individuals older than 15 who were employed during the year of the interview); the consumption rate of drugs (*drug_consumption*, the share of individuals who used drugs in the two days before the interview); and the level of public health expenditure per-capita (*health_spending*). Summary statistics for all the variables included in the estimated models are shown in Table 2. Elderly people in the sample are about 20%, and the foreigners living in Italy are only about 2% of the sample. The percentage of people with a very low level of education is relatively small (about 28%), while more than 40% of individuals was employed during the year of the interview. Finally, consumption of drugs is quite diffused (34%) and the average public health expenditure per-capita is around 1200 euro over the whole sample period.

Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
KM index	0.397	0.031	0.291	0.470
GDP (€)	1980.036	583.894	907	3312
DECENTR	0.615	0.487	0	1
inequality_home_care	-0.009	0.014	-0.054	0.054
inequality_emergency_care	-0.011	0.021	-0.078	0.062
inequality_contacts_LHA	0.033	0.057	-0.121	0.297
inequality_inpatient_care	-0.011	0.015	-0.054	0.030
inequality_diet	-0.017	0.046	-0.143	0.138
inequality_smoke	-0.014	0.028	-0.130	0.064
population_over65 (%)	18.969	3.085	12.090	26.740
population_foreign (%)	2.247	1.758	0.280	7.590
population_primaryedu (%)	27.896	16.180	0.363	46.930
population_employment (%)	42.908	6.390	31.590	54.870
drug_consumption (%)	34.199	4.779	24.750	45.320
health_spending (€)	1237.142	327.724	694	2014
Nr. Observations	247			

Table 2. Summary statistics of the variables used in model [1]

5. Results

5.1. Baseline results

Table 3 shows the estimated impact of fiscal decentralization on within-regional health inequalities under alternative specifications of Equation [1]. All these specifications include

the set of possible confounding factors X_{it}, regional fixed effects R_i, and year fixed effects T_t, to account for unobserved residual heterogeneity across regions as well as the presence of a common time trend. MODEL 1 refers to the baseline specification of equation [1], without any controls for possible anticipatory effects (*leads*) and post-treatment effects (*lags*). MODELS 2 to 5 test the robustness of the baseline results by including q leads and m lags of the treatment effect. More precisely, all the models account for three anticipatory effects (*GDP*×1 *Year Prior* = 1997, *GDP*×2 *Years Prior* = 1996, *GDP*×3 *Years Prior* = 1995). As for the lags, MODEL 2, MODEL 3, MODEL 4 and MODEL 5 include 1, 2, 3 and 4 post-treatment effects, respectively: *GDP*×1 *or More Years After* refers to time period 1999-2007 in MODEL 2 and only to year 1999 in MODELS 3-5; *GDP*×2 *or More Years After* refers to time period 2000-2007 in MODEL 3 and only to year 2000 in MODELS 4-5; *GDP*×3 *or More Years After* refers to time period 2001-2007 in MODEL 4 and only to year 2001 in MODEL 5; *GDP*×4 *or More Years After* refers to time period 2002-2007. Finally, in all the models *GDP*×*Year of Adoption* refers only to the effect of tax decentralization observed in 1998, when the reform was implemented.

Estimates in Table 3 provide a consistent picture across the different specifications. Looking at MODEL 1, the coefficient on the interaction *GDP*×*DECENTR* is negative and statistically significant. Given the evolution characterizing within-regional inequality, this means that the tax decentralization reform helped contain disparities. According to the discussion above, this result might hide differences in pre-trends and/or in post-treatment effects that are not controlled for in the baseline model. However, looking at the extended specifications (MODELS 2-5), the coefficients for the three leads are always statistically insignificant, supporting the common trend assumption underlying our empirical strategy. In all the models the estimated coefficient for the year of adoption of the reform (*GDP*×*Year of Adoption*) is still negative, but no longer statistically significant. More important, coefficients for the lags reveal that the effect of the reform emerge only after two years from its adoption – being also the coefficient for *GDP*× 1 *or More Years After* not statistically significant in all models excepting MODEL 2 – and then remains relatively constant over time: the coefficients for *GDP*×2 *or More Years After*, *GDP*×3 *or More Years After* and *GDP*×4 *or More Years After* are all statistically significant and similar in magnitude. In particular, the Average Treatment Effect (computed at the sample mean value of GDP in the years from 2000 to 2007) points out a reduction in *KM* of almost 4 times its standard deviation. The impact of fiscal decentralization on health inequalities clearly differs according to the

exposure to treatment, with much stronger effects in richer Northern regions compared to poorer Southern ones. Looking for instance at MODEL 5 (the most complete specification), *ceteris paribus*, the impact of the decentralization reform after four years since its introduction (time period 2002-2007) consists of a reduction in *KM* which varies from about 2.5 times the standard deviation for the region with the lowest per capita GDP (Calabria, on average 1559 euro) to about 5 times the standard deviation for the region with the highest per capita GDP (Lombardy, on average 3146 euro). Hence, the decentralization reform had more pronounced effects in the regions that experienced a substantial increase in their fiscal autonomy; and these effects were not enough to contrast the increasing inequalities in poorer regions. This suggests that the increased accountability of regional governments was beneficial not only to foster efficiency, but also to avoid the deterioration of within-regional inequalities, as highlighted by the difference in the evolution of KM index in Figures 1a-1b discussed above.

Regressors	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
GDP×DECENTR	-1.878** (0.790)	-	-	-	-
GDP× 3 *Years Prior*	-	-1.641 (1.966)	-2.086 (1.990)	-2.037 (2.001)	-2.063 (2.072)
GDP× 2 *Years Prior*	-	-1.750 (1.608)	-2.349 (1.745)	-2.280 (1.778)	-2.317 (1.888)
GDP× 1 *Year Prior*	-	-0.454 (1.935)	-1.192 (2.016)	-1.114 (2.029)	-1.146 (2.139)
GDP×Year of Adoption	-	-2.105 (1.801)	-2.954 (1.934)	-2.861 (1.966)	-2.906 (2.095)
GDP× 1 *or More Years After*	-	-3.345* (1.918)	-2.314 (1.738)	-2.220 (1.763)	-2.278 (1.930)
GDP× 2 *or More Years After*	-	-	-5.082** (2.246)	-5.268** (2.224)	-5.332** (2.408)
GDP× 3 *or More Years After*	-	-	-	-4.820* (2.345)	-4.740** (2.138)
GDP× 4 *or More Years After*	-	-	-	-	-4.957* (2.810)
Vector of controls *X*	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Within R^2	0.50	0.51	0.52	0.53	0.53
Nr. of observations	247	247	247	247	247

Table 3. The impact of fiscal decentralization on health inequalities [(a)]

[(a)] The dependent variable is the index of inequality in self-assessed health (*KM*). Cluster–robust standard errors at the Region level are reported in round brackets. MODEL 2-5 extend the baseline specification to include *leads* (*GDP*×1 *Year Prior* = 1997, *GDP*×2 *Years Prior* = 1996, *GDP*×3 *Years Prior* = 1995) and *lags* (*GDP*×1 *or More Years After* refers to time period 1999-2007 in MODEL 2 and only to year 1999 in MODELS 3-5; *GDP*×2 *or More Years After* refers to time period 2000-2007 in MODEL 3 and only to year 2000 in MODELS 4-5; *GDP*×3 *or More Years After* refers to time period 2001-2007 in MODEL 4 and only to year 2001 in MODEL 5; *GDP*×4 *or More Years After* refers to time period 2002-2007). *GDP×Year of Adoption* refers only to the effect of decentralization observed in year 1998.

** statistically significant at 5%; * statistically significant at 10%.

As for the role played by controls, results are also consistent across the different models, with most variables not exerting a significant influence on *KM*.[9] Among the six inequality indexes, only inequality in home care is positively correlated – as expected – with *KM*, while for the remaining variables we do not find evidence of statistically significant effects. Looking at regional characteristics, the estimates show that *KM* reduces with the percentage of foreign people, while it increases with the consumption rate of drugs. The first result might capture the fact that foreigners tend to cluster where opportunities to work are better, hence in richer regions. The second result might be due to the fact that the assessment of own health conditions is likely to be more heterogeneous within the group of drug consumers, in which there are both people who use drugs for minor ailments and people with serious diseases.

5.2. Robustness checks

Our results might be influenced by three important sources of bias: first, some regions in Italy enjoy a "Special Statute", which have granted them a higher degree of autonomy on a number of issues since the end of the second World War; second, some regions might have used deficits to inflate spending in health care, and this increased spending might have influenced health outcomes as well; third, a reform impacting on the financing mechanism of hospitals – which was deploying its effects since 2007 - might have produced better outcomes in richer regions. We address these three issues in turn.

Table 4 reports the same set of specifications presented in Table 3 estimated on a reduced sample which excludes the Special Statute regions (Friuli Venezia Giulia and Trentino Alto Adige in the North, Sardinia and Sicily in the South). These regions are very different in terms of population and GDP per-capita, but also in terms of the relationships they maintain with the central government[10]. Results reported in Table 4 largely confirms previous findings, and the validity of the common trend assumption. However, while the coefficient on the interaction *GDP×DECENTR* remains negative and statistically significant in MODEL 1, now also the coefficient on *GDP×Year of Adoption* is statistically significant in most of the specifications including lags. The delay with which the fiscal reform seems to have produced its effects seems to be entirely due to Special Statute regions, which were

[9] The coefficients for this set of controls are not included for sake of brevity but they are available on request.

[10] For instance, the two autonomous provinces making up Trentino Alto Adige retain almost all the revenues they raise in their territory, receiving virtually no transfers from the central government, and also having spending autonomy on education. On the contrary, Sicily receives transfers from the central government even if it retains revenues and does not have spending autonomy on education.

blurring the initial impact of the increase in revenue autonomy. Still, the magnitude of the impact increases in the years after the introduction of the reform, confirming the idea that it takes time for the reform to completely generate its effects.

Regressors	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
GDP×DECENTR	-2.160** (0.847)	-	-	-	-
GDP× 3 *Years Prior*	-	-3.005 (2.822)	-3.592 (2.820)	-3.490 (2.845)	-3.670 (2.950)
GDP× 2 *Years Prior*	-	-2.231 (1.941)	-2.963 (1.920)	-2.817 (1.929)	-3.022 (2.047)
GDP× 1 *Year Prior*	-	-2.091 (2.617)	-2.982 (2.598)	-2.871 (2.614)	-3.013 (2.707)
GDP×Year of Adoption	-	-3.289 (2339)	-4.347* (2.237)	-4.174* (2.249)	-4.409* (2.357)
GDP× 1 *or More Years After*	-	-5.059* (2.453)	-3.887* (2.172)	-3.697 (2.201)	-3.996 (2.330)
GDP× 2 *or More Years After*	-	-	-7.253** (2.444)	-7.623*** (2.570)	-7.947** (2.730)
GDP× 3 *or More Years After*	-	-	-	-6.729** (2.458)	-6.429** (2.228)
GDP× 4 *or More Years After*	-	-	-	-	-7.449** (2.970)
Vector of controls *X*	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Within R^2	0.48	0.49	0.52	0.52	0.53
Nr. of observations	195	195	195	195	195

Table 4. The impact of fiscal decentralization on health inequalities excluding Special Statute Regions [(a)]

[(a)] Special Statute Regions are: Friuli Venezia Giulia, Trentino Alto Adige, Sardegna and Sicilia. The dependent variable is the index of inequality in self-assessed health (*KM*). Cluster–robust standard errors at the Region level are reported in round brackets. MODEL 2-5 extend the baseline specification to include *leads* (*GDP*×1 *Year Prior* = 1997, *GDP*×2 *Years Prior* = 1996, *GDP*×3 *Years Prior* = 1995) and *lags* (*GDP*×1 *or More Years After* refers to time period 1999-2007 in MODEL 2 and only to year 1999 in MODELS 3-5; *GDP*×2 *or More Years After* refers to time period 2000-2007 in MODEL 3 and only to year 2000 in MODELS 4-5; *GDP*×3 *or More Years After* refers to time period 2001-2007 in MODEL 4 and only to year 2001 in MODEL 5; *GDP*×4 *or More Years After* refers to time period 2002-2007). *GDP×Year of Adoption* refers only to the effect of decentralization observed in year 1998.

*** statistically significant at 1%; ** statistically significant at 5%; * statistically significant at 10%.

Table 5 shows the estimates from a similar exercise on a reduced sample obtained by excluding Lazio, Campania and Sicily, the three regions whose deficits for health spending in the period 1998-2007 (after the reform was implemented) summed up to more than 50% of the whole aggregated deficit of all regions (Tediosi et al., 2009). Results are strongly confirmed also in this case: the tax reform starts producing its effects two years after the introduction. Since Sicily was excluded also from estimates in Table 4, it is likely that are the richest Special Statute regions in the North to affect the results on the timing of the impact of the decentralization reform, further suggesting that the actual fiscal autonomy is what really matters.

Regressors	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
GDP×DECENTR	-1.585 (1.026)	-	-	-	-
GDP× 3 *Years Prior*	-	-1.477 (2.626)	-1.904 (2.654)	-1.834 (2.661)	-1.832 (2.719)
GDP× 2 *Years Prior*	-	-3.056 (1.876)	-3.624 (2.015)	-3.523 (2.049)	-3.520 (2.137)
GDP× 1 *Year Prior*	-	-1.346 (2.444)	-2.070 (2.516)	-1.962 (2.513)	-1.959 (2.633)
GDP×Year of Adoption	-	-2.587 (2.445)	-3.424 (2.506)	-3.290 (2.526)	-3.285 (2.617)
GDP× 1 *or More Years After*	-	-3.985 (2.328)	-2.933 (2.125)	-2.807 (2.137)	-2.801 (2.272)
GDP× 2 *or More Years After*	-	-	-5.586** (2.578)	-5.969** (2.615)	-5.963** (2.753)
GDP× 3 *or More Years After*	-	-	-	-5.183* (2.640)	-5.194* (2.467)
GDP× 4 *or More Years After*	-	-	-	-	-5.167* (3.063)
Vector of controls *X*	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Within R^2	0.47	0.49	0.50	0.50	0.50
Nr. of observations	208	208	208	208	208

Table 5. The impact of fiscal decentralization on health inequalities excluding Regions with a high deficit in the post-reform period [(a)]

[(a)] The excluded Regions (Lazio, Campania and Sicilia) are those whose deficits for health spending in the period 1998-2007 summed up to more than 50% of the whole aggregated deficit computed for all Regions. The dependent variable is the index of inequality in self-assessed health (*KM*). Cluster–robust standard errors at the Region level are reported in round brackets. MODEL 2-5 extend the baseline specification to include *leads* (*GDP*×1 *Year Prior* = 1997, *GDP*×2 *Years Prior* = 1996, *GDP*×3 *Years Prior* = 1995) and *lags* (*GDP*×1 *or More Years After* refers to time period 1999-2007 in MODEL 2 and only to year 1999 in MODELS 3-5; *GDP*×2 *or More Years After* refers to time period 2000-2007 in MODEL 3 and only to year 2000 in MODELS 4-5; *GDP*×3 *or More Years After* refers to time period 2001-2007 in MODEL 4 and only to year 2001 in MODEL 5; *GDP*×4 *or More Years After* refers to time period 2002-2007). *GDP×Year of Adoption* refers only to the effect of decentralization observed in year 1998.

** statistically significant at 5%; * statistically significant at 10%.

Finally, we consider the potential source of bias on our results stemming from the quasi-markets reform implemented in Italy during the Nineties. This reform, inspired by the UK experience, was aimed at improving spending efficiency (the same goal of the tax decentralization reform) working at a more micro level. In particular, spending efficiency had to be obtained by introducing a new prospective payment scheme for hospitals with fixed prices based on Diagnosis Related Groups. The new payment system became effective in 2007, but regions were allowed to differentiate tariffs with respect to national prices. However, only few regions did introduce their own tariffs at different times: in particular, some of the richest regions (Lombardy and Emilia Romagna) were among the first in adopting their own set of tariffs since 2007, followed by Veneto in 2008. We exploit this variability across regions and years in the adoption of own tariffs to define the dummy variable *QM*, mnemonic for quasi-markets, taking value one when a region adopted a set of

tariffs different from national ones. Table 6 presents the estimates obtained from an augmented version of Eq. [1], which includes also the variable *QM*. Our results are largely confirmed also in this case, in terms of sign, magnitude and significance. Moreover, the coefficient associated to the variable *QM* is never statistically significant at the usual confidence levels, suggesting that the introduction of quasi-markets did not have any impacts on inequalities. This finding is in line with Cappellari et al. (2016), who show that price incentives introduced by the quasi-markets reform did not affect perceived health, while reducing inappropriate access to some services, with stronger effects in the first years immediately after the reform.

Regressors	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
GDP×DECENTR	-2.033** (0.944)	-	-	-	-
GDP× 3 *Years Prior*	-	-1.652 (1.969)	-2.091 (1.997)	-2.041 (2.009)	-2.065 (2.080)
GDP× 2 *Years Prior*	-	-1.764 (1.632)	-2.355 (1.768)	-2.285 (1.799)	-2.319 (1.907)
GDP× 1 *Year Prior*	-	-0.656 (2.065)	-1.335 (2.196)	-1.265 (2.215)	-1.290 (2.310)
GDP×Year of Adoption	-	-2.333 (2.048)	-3.114 (2.245)	-3.030 (2.279)	-3.067 (2.392)
GDP× 1 *or More Years After*	-	-3.562 (2.192)	-2.477 (2.088)	-2.393 (2.115)	-2.441 (2.259)
GDP× 2 *or More Years After*	-	-	-5.229* (2.583)	-5.433** (2.529)	-5.487* (2.696)
GDP× 3 *or More Years After*	-	-	-	-4.969* (2.688)	-4.890* (2.488)
GDP× 4 *or More Years After*	-	-	-	-	-5.092* (3.108)
Vector of controls *X*	Yes	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Within R^2	0.50	0.51	0.52	0.53	0.53
Nr. of observations	247	247	247	247	247

Table 6. The impact of fiscal decentralization on health inequalities controlling also for the effect of the quasi-markets reform [(a)]

[(a)] The effect of the quasi-markets reform is tested by including in the vector of controls *X* also a dummy variable *QM* equal to one when the Regions adopt their own set of DRG tariffs. The dependent variable is the index of inequality in self-assessed health (*KM*). Cluster–robust standard errors at the Region level are reported in round brackets. MODEL 2-5 extend the baseline specification to include *leads* (*GDP×*1 *Year Prior* = 1997, *GDP×*2 *Years Prior* = 1996, *GDP×*3 *Years Prior* = 1995) and *lags* (*GDP×*1 *or More Years After* refers to time period 1999-2007 in MODEL 2 and only to year 1999 in MODELS 3-5; *GDP×*2 *or More Years After* refers to time period 2000-2007 in MODEL 3 and only to year 2000 in MODELS 4-5; *GDP×*3 *or More Years After* refers to time period 2001-2007 in MODEL 4 and only to year 2001 in MODEL 5; *GDP×*4 *or More Years After* refers to time period 2002-2007). *GDP×Year of Adoption* refers only to the effect of decentralization observed in year 1998.

** statistically significant at 5%; * statistically significant at 10%.

5.3. Discussion

In this section we aim at discussing some explanations for why tax decentralization helped contain within-regional inequalities in health outcomes more in Northern regions than in Southern ones. A first possible mechanism underlying the relationship between increased accountability of regional governments and lower health disparities may be that the greater fiscal autonomy after 1998 positively influenced regional economic growth (e.g., Akai and Sakata, 2002). This in turn stimulated private health spending, making it to grow more in the North than in the South. We investigated formally the validity of this argument following two strategies.[11] First, we tested the impact of decentralization on both per capita GDP and private health spending, by estimating a model mirroring equation [1], where the effect of the tax reform was allowed to be different in Northern and Southern regions (used as treated and control group, respectively) and a complete set of *leads* and *lags* of the treatment was considered. As largely expected, for both variables we found a remarkable difference in the trend of growth between the two groups of regions, but no evidence of a divergence due to decentralization: per capita GDP and private health spending grew more in the North than in the South over the entire 1994-2007 period. To be sure, we also re-estimated our original models in Table 3 by substituting per capita public spending with total spending for health care. Baseline results are basically unaffected also when considering total spending; hence, we do not find any evidence to support the hypothesis that our findings are driven by an "income" effect induced by the 1998 tax reform.

A second explanation is based on regional governance: richer and financially more autonomous Northern regions might have exploited a higher ability in managing the devolution process, implementing more targeted health care policies. In this respect, regional screening programs to prevent breast cancer represent an interesting policy issue to look at. Breast cancer is one of the most important concerns for health in Europe because of its high incidence and high mortality risk (e.g., Ferlay et al., 2013). Moreover, recent empirical evidence highlights that inequalities in the use of mammography are stronger in countries like Italy without a national screening program (e.g., Carrieri and Wuebker, 2013), and the effectiveness of these programs in increasing preventive uptakes is higher among low educated women (e.g., Carrieri and Wuebker, 2016). This suggests that if – following fiscal decentralization – Northern regions were more able to adopt effective screening

[11] Results for these two exercises are not reported here for brevity, but are available upon requests from the authors.

policies, we expect to observe a higher increase in prevention rates in these regions, and the difference with respect to Southern regions should be particularly marked for lower educated women. We cannot run a rigorous test of the impact of tax reform on prevention rates, as information on the use of mammography are available only for three years, 1994, 2000 and 2005. However, we can provide some descriptive evidence of the average increase in mammography uptakes from 1994 to the period 2000-2005, for women over 40 and with different education levels, comparing Northern and Southern regions. Data highlight a marked difference in the growth of mammography use rates between the two geographic areas (+16% in the North vs. +10% in the South) and, more importantly, confirm that the gap is particularly strong among women with no education (+16% vs. +5%) and primary education only (16% vs. 9%), while it reduces or even vanishes for higher levels of education. As those less educated are presumably also the poorest individuals, this might help explain why in Southern regions we observe a deterioration of health inequalities compared to Northern ones.

6. Concluding remarks

In this paper we exploit the introduction in 1998 of two new sources of autonomous revenue for Italian regions, characterized by stark differences in the availability of the tax bases, to analyze the impact of a fiscal decentralization reform on inequalities in health outcomes (measured as self-reported health) between and within regions. Our findings show that the fiscal decentralization reform did not affect between-regional inequalities and contributed to a significant containment of within-regional health inequalities after two years from its implementation. The magnitude of the estimated impact, however, differs according to the level of economic development of each region, with stronger effects in richer regions compared to poorer ones.

An important implication of our findings is that, besides reducing inefficiencies and lowering spending for given services provided to citizens (e.g., Piacenza and Turati, 2014), fiscal decentralization seems to be effective in reducing also inequalities in health outcomes. However, the degree of economic development – which eventually determines the actual degree of fiscal autonomy – significantly affects the effectiveness of such reforms. This result highlights the importance to account for the specific features of the context where the decentralization of fiscal powers is implemented (e.g., Bardhan, 2002).

In the Italian case, the evidence discussed in this study tends to support the institutional design of a "two-way" fiscal federalism: for the richer areas of the country one can strengthen tax autonomy and expect to obtain successful outcomes, via the improved fiscal accountability following the substantial increase in autonomy. On the contrary, for the less developed regions of the *Mezzogiorno*, it would be better to first implement policies aimed at correcting the structural factors that impede the proper functioning of decentralized fiscal powers, and only later to push on tax decentralization.

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