

# Region of residence and equality of opportunity in health: a note on the Italian case

## **Abstract**

The Italian health care system is managed mainly at the regional level. For this reason health care may differ depending on region of residence. The aim of this note is to take a rigorous ex-ante approach and test for equality of health opportunities as opposed to health outcomes, which are the ex-post results. We perform non-parametric tests to evaluate if the probability of reaching the same health status differs by region of residence, after controlling for other influential factors such as age, gender and income. The results underline that the geographical distribution of opportunities in health is unequal, and therefore, that regional differences in outcomes are more likely to be expected.

Keywords: health inequality, equality of opportunity, stochastic dominance, EU-SILC.

JEL Classification: D31, I18.

# 1 Introduction

A comprehensive study on the distribution of well-being within a given society cannot presume from analyzing inequalities in health, one of the most relevant dimensions of individual well-being with income and education (Fleche et al., 2011).

The large literature on health inequality focuses mainly on socioeconomic disparities in health outcomes, explaining health inequalities through differences in living and working conditions or access to health care (see for example Wagstaff and van Doorslaer, 2000; van Doorslaer and Jones, 2003; Allison and Foster, 2004; van Doorslaer and Koolman, 2004; Jones and Lopez, 2004; Wildman and Jones, 2008; Zheng, 2011).

Many empirical studies on health inequality in Italy are also available. We refer in particular to Lucchini et al. (2009) and to Di Novi et al. (2012), who reveal that the main drivers of the Italian health inequalities are individual characteristics such as age, gender, education and income, but also the regional differences in health status appear to be relevant.

Beside this strand of the literature, recent contributions have focused on the link between health inequalities, on the one hand, and social choice and individual responsibility, on the other. Fleurbaey and Shokkaert (2009), in particular, underline the distinction between ethically “legitimate” inequalities, due to individual choice and responsibility such as the lifestyle, and “illegitimate” inequalities in health, caused by socioeconomic background or by the country’s region of residence. Aim of these authors is measuring not the inequality in health as such, but only the unfair inequality in health, due to causes that do not belong to the sphere of the individual responsibility.

Other authors have started to depart from measuring inequality of outcome (health status or health care) towards monitoring the so-called inequality of opportunity. These studies are interested in determining whether individuals belonging to different backgrounds are endowed with the same opportunities. In this sense, this approach is *ex-ante*, before the health outcomes occur, which are the *ex-post* results. The seminal contributions in this field are due to Roemer (1998, 2002), according to whom an individual *outcome* (such as income, education, health) is influenced both by *effort*, factors for which individuals are responsible, and by *circumstance*, factors which are beyond individual control and are the only source of illegitimate inequality.

The literature on equality of opportunity in health has considerably flourished in the last years; see, for example, Fleurbaey (2008), Rosa Dias and Jones (2007), Fleurbaey and Schokkaert (2009), Rosa Dias (2009, 2010), Trannoy et al. (2010), Li Donni et al. (2011). Most of these contributions aim to evaluate whether the distribution of adult health (out-

come) is affected by the types of school, or by the educational level attained, or by the social and familial background (circumstances). Rosa Dias (2009), in particular, applies stochastic dominance criteria to establish whether British adult health distribution depends on parental economic status and on childhood health and measures the extent of this dependence through the Gini-opportunity index proposed by Lefranc et al. (2008).

A different approach is adopted by Li Donni et al. (2011), who propose a method to decompose the overall health inequality in the UK into a legitimate and an illegitimate component, in order to evaluate the role played by the social economic background on individual health achievements during adulthood, in comparison to the individual choices on health related habits.

To the best of our knowledge, no empirical application of equality of opportunity in health has been proposed for the study of the Italian case; this note aims to fill this gap.

The Italian health care system is managed mainly by the 19 regions and 2 autonomous provinces into which Italy is divided. (For simplicity, henceforth we will refer to the 19 regions and 2 autonomous provinces as “21 regions”.) Empirical evidence has already highlighted that the high variability across the Italian regions in the quality of health care affects health outcomes (see, among others, Jappelli and Padula, 2003). These differences depend on how public resources are managed by regional administrations and local health providers. Jappelli and Padula (2003) also report that the individual health status is on average better where the per capita health expenditures are relatively higher. According also to Di Martino (2008) the regional area of residence in Italy plays a significant role in the determination of the health status of Italians. For this reason health benefits occurring to each individual may differ depending on the region of residence. The Italian health system is characterized by free mobility of patients throughout the country, so that patients can choose where to be cured. But, obviously, not all patients can move since it takes time, money and knowledge to organize a trip which generally involves moving not only the patient but also its close family.

Given these premises on the health care system in Italy, the aim of this note is to propose a different analysis of equality of health opportunities, by testing if the probability of reaching the same health status differs by region of residence, after controlling for other influential factors such as differences in age, gender and incomes.

We are inspired, in particular, by Fleurbaey and Schokkaert (2009)’s idea that also the place of residence may cause inequalities of opportunity; specifically, they affirm that “in addition to socioeconomic background, there are many more causes of inequalities that may be a cause of ethical concern. (...) Is it less problematic if someone is denied health care be-

cause she lives in another region of the country? (Or, for that matter, in another country?)” (p.74).

Our choice to consider the region of residence as a circumstance is, therefore, motivated both theoretically by the literature on Equality of Opportunity (see Fleurbaey and Schokkaert, 2009) and by some empirical evidence, as discussed above. We suggest to consider the place of residence as one of the possible causes of illegitimate inequalities, together with education and income, thus providing justification for regional policies aim at homogenizing further the standards of health services offered to citizens.

To the best of our knowledge, our note is the first to analyze inequality of opportunity in health considering as circumstances, and hence as an unfair source of health inequality, the region (or country) of residence.

We follow Roemer (1998, 2002)’s theoretical approach and Lefranc et al. (2009)’s empirical strategy which is the standard practice in the health economics literature. For a detailed comparison between the approaches see Rosa Dias (2009).

Our empirical analysis is based on the IT-SILC 2009 dataset, which contains information on income and living conditions of a representative sample of Italian citizens referring to the year 2009. This is the most recent dataset that collects information both on income and on self-assessed health status of Italian adults. Results show that in Italy in the year 2009 there exists inequality of health opportunity, in sense that the distribution of health status, after controlling for age, gender and income, depends significantly on the region of residence. In particular, our results support the idea that the region of residence is an important determinant of the individual health achievement, beside the individual lifestyle.

This note is structured as follows. In the next section we briefly summarize the Italian health care system in order to underline how its organization may affect the equality of health opportunity in Italy; in Section 3 we introduce and discuss our regional model; in Section 4 we describe the dataset employed for the analysis; in Section 5 we comment the results from the empirical application. Section 6 concludes.

## **2 The Italian health care system: a brief review**

Starting from the year 1978 the Italian health care system is characterized by a National Health Service (“Servizio Sanitario Nazionale”, henceforth SSN), modeled on the British National Health Service. It is a universal system that provides comprehensive health insurance coverage and uniform health care to the entire population. The majority of Italians rely on health care provided directly or indirectly by the National Health Service. The SSN

combines public and private provision; private hospital and ambulatory services may also act as providers for the Italian SSN if they receive the accredited status and have a contract with the SSN. (More details on the Italian SSN can be found in France et al. (2005) and Donatini et al. (2001).)

A series of reforms have gradually increased the importance of the 21 regions versus the central government. Nowadays the main tasks that remain in charge of the central government are (i) defining the essential levels of care (“Livelli Essenziali di Assistenza”), which are a list of services that the SSN is required to provide uniformly in all the regions, (ii) setting the budget of the SSN and sharing it among the regions, controlling and, in case, financing and paying off debts of the regions, (iii) guaranteeing financial interregional solidarity, according to which the regions with lower average income benefit from transfers from richer regions; see e.g. Bordignon et al. (2002). The 21 regions have the responsibility for the organization, funding and administration of publicly financed health care. Moreover, 5 of the Italian regions are special statute regions, in sense that they are legislative bodies in the range of their competence, can legislate regulating their own territories and decide which functions to implement. Special regions have generally been attributed more functions than ordinary regions; their primary source of revenue is shared national taxes. They are the large islands (Sicilia and Sardegna) and small regions close to the national borders with a high percentage of foreign population (Valle d’Aosta, Trento and Bolzano provinces, Friuli Venezia Giulia).

This decentralized organization of the SSN implies regional differences in (i) funding, (ii) expenditure, and (iii) quality of the health care and delivery.

As far as the first point is concerned, the SSN funding is mainly based on regional taxation and on transfers from the central government to those regions that are economically and fiscally weaker. More in detail, the public health care system is financed through the following sources of taxation: regional add-ons to the national personal income tax (“Addizionale Regionale IRPEF”), central grants (“Fondo per il fabbisogno sanitario ex D.Lvo 56/2000”) financed by the value-added tax (VAT) and other indirect tax (e.g. excise tax on fuel products) revenues, the business tax IRAP, and transfers from the state (“ex FSN”). Depending on individual income, age and health condition, co-payments are imposed for specialist consultations, drugs, ambulatory treatments, certain diagnostic and laboratory tests.

An important step in the procedure of the establishment of the health care system’s financing is constituted by the periodical negotiation between the central government and the regions (“Accordo Stato-Regioni”) to decide how to allocate the amount of central govern-

ment funding among regions, according to their health care needs; this often causes huge political frictions. The formula for the allocation of the resources has changed several times; at the moment it is based on the regional population size, weighed by age-specific utilization rates for hospital care, drugs and residential care, on the standardized mortality rate and on an adjustment for interregional patient flows (see Mapelli, 2007, and the reference therein).

Moving to the second source of disparity across regions, in 2009, which is the year of interest for our empirical analysis, the per capita expense was equal to 1,826 euro, with considerable regional variability: a minimum per capita expense in Sicilia region equal to 1,671 euro against maximum expenses in Bolzano and Trento provinces, Valle d'Aosta, Liguria and Molise (see Ministero dell'Economia e delle Finanze, 2010 and OECD, 2011). These data are not adjusted for patients' mobility and the population's structure by age. However, also controlling for these characteristics, spending differentials across regions remain significant, mainly due to the differences in the quality and efficiency of the regional health services; see Francese and Romanelli (2011) and the references therein.

Thirdly, differences among regions are also due to different quality of health care and delivery; see Jappelli and Padula (2003). In particular, the Italian Ministry of Health has recently elaborated a set of indicators aimed at measuring the performance of the regional health systems;<sup>1</sup> within this analysis Campania, Molise and Puglia regions are at the bottom of the ranking for almost all the indicators, while Emilia Romagna, Friuli Venezia Giulia and Bolzano are often the regions performing the best.

These regional disparities in the health care organization strongly motivate our analysis of equality of opportunity in health in Italy.

The Italian health system is characterized by free mobility of patients throughout the country, so that patients can choose where to be cured. The net interregional mobility of one region is measured as the difference between the total revenue that the region receives from all the regions whose residents are cured in that region, minus the money that the region gives to those regions where its residents are treated. In the year 2009 the regions with highest positive interregional mobility were Lombardia and Emilia Romagna, while the regions with highest negative interregional mobility were Campania, Calabria and Sicilia (see Ministero dell'Economia e delle Finanze, 2010). As discussed in Levaggi and Zanola (2004), the interregional mobility of patients can be considered as a proxy for the quality of the health related services provided by the regions. In particular, the authors point out that patients living in regions that provide health services of higher quality tend to move

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<sup>1</sup>Among these indices there are the standardized hospitalization rate and the average confinement performance index; see Ministero della Salute (2008).

less than patients living in other regions.

### 3 Analyzing equality of opportunity in health

Generally speaking Equality of Opportunity (henceforth, EOp) measures to what extent individuals belonging to different backgrounds are endowed with the same opportunities.

More specifically, equality of opportunity in Roemer (1998)'s work assumes that an individual *outcome* (such as income, education, health) is determined mainly by two classes of variables: *circumstances*, which include all factors outside the individual responsibility, and *effort*, which includes factors for which individuals are responsible. There exists equality of opportunity if the distribution of the outcome of interest is independent of the circumstances; otherwise, if the outcome distribution differs across circumstances, opportunities are unequally distributed. Roemer (2002) suggests of sorting individuals into *types* according to their circumstances; within each type, differences in outcome are generated by different effort. According to this view, there is equality of opportunity if, on average, all those who exert the same effort have an equivalent outcome, irrespective of their circumstances.

The literature on EOp has focused mainly on education and income inequality, aimed at establishing whether the distribution of incomes or earnings differs with the parental education; see, among others, Bourguignon et al. (2007), Checchi and Peragine (2010), Ferreira and Gignoux (2008), Lefranc et al. (2008, 2009), Peragine (2004), Peragine and Serlenga (2008).

Analyses on opportunity inequality concerning income and education have been proposed for Italy by Peragine and Serlenga (2008) and Checchi and Peragine (2010). In Checchi and Peragine (2010), in particular, earnings inequality is decomposed into the contribution due to the level of parental education (considered as circumstances) and the individual effort, controlling for gender and regional disparities, in order to monitor the differential intensity of opportunity inequality across regional areas.

An interest in analyzing also equality of opportunity in health has been rapidly flourishing. The most recent contributions are, among others, Rosa Dias and Jones (2007), Fleurbaey and Schokkaert (2009), Lefranc et al. (2009), Rosa Dias (2009, 2010), Trannoy et al. (2010), Li Donni et al. (2011). The cited papers provide evidence of substantial and persistent inequality of opportunity in health in some European countries.

The test of Roemer's approach is performed in some of these contributions following the method introduced by Lefranc et al. (2009), which consists of testing for first order stochastic dominance among the distributions of outcome provided by different circumstances. Jones,

Rice and Rosa Dias (2010), in particular, assess inequality of opportunity in health by testing for first order stochastic dominance in the distribution of adult health outcomes across types of school, while Trannoy et al. (2010) analyze the role played by childhood circumstances, especially social and family background, in explaining health status among older adults.

A slight different approach is proposed in Li Donni et al. (2011), who provide a decomposition of the overall health achievement inequality into a fair component, due to individual choices on healthy habits, and an unfair component, driven by social economic background.

Within this literature, no contribution has been proposed so far **neither to analyze where Italy stands nor to consider as circumstances the place of residence**. In this note, we propose a first analysis of equality of health opportunity in Italy.

### 3.1 Region of residence and health

According to social epidemiology studies, the main determinants of health inequality are: (i) biological factors, such as age and lifestyle, (ii) educational level and income, and (iii) place of residence (see Lucchini et al., 2009, and the references therein). The latter could be due not only to economic deprivation of some geographical areas, and to environmental elements such as pollution, but also to access, availability and performance of the local health related services. In Italy, this appears particularly relevant due to the federal structure of the SSN.

Several researchers have recently investigated the effects of the place in which the individuals live on health status and have found a significant impact of this characteristic on several measures of health; see, among others Carrieri and Bilger (2011). The effect of the area of residence remains significant even after controlling for several individual socio-economic conditions (see Pickett and Pearl, 2001). Van Doorslaer and Koolman (2004) find that the region of residence does matter in the Mediterranean countries; Italy, in particular, is one of the countries with the highest geographical differences in health status across developed countries. One of the main reason that could explain this fact is the quality of the health care service provided. As discussed in Baldini and Turati (2012), Italy is characterized by wide differences between the Northern and the Southern part of the country in terms of the quality of health related services; the percentage of people very satisfied in the Northern regions is almost twice as high as the same percentage in the Southern regions.

These regional disparities in the quality of health care services led us to consider the region of residence as a circumstance for the evaluation of equality of opportunities. Italian patients are free to move across regional borders, as we have discussed in Section 2, but this mobility could be strongly affected by financial resources and internal organization of the patient's



family, and also by the age of the patient and the urgency of the care.

We assume that differences in climate and in the distribution of genetic defects across Italian regions do not affect the analysis.<sup>2</sup>

The equality of health opportunity across Italian regions may be interpreted from the point of view of “equal treatment of the equals”; and this fact can be measured from different points of view: looking at either the outcome or the input of the process. Various studies focus on the input and measure horizontal equity of health care services across regions, comparing the regional per capita health care expenditure. For example, Bordignon, Fontana and Peragine (2006) assume that there exists equality in health care delivery across the Italian regions if the health expenditure is the same; this is a strong assumption that does not take into account the regional differences in efficiency. In this note we adopt a different approach and look instead at the outcome, that is, at the effective health status reported by the patients, in order to establish whether differences exist in the distribution of health among regions.

Health status among individuals differs on average depending on age and gender; see for example the discussion in Gravelle (2003). Evidence shows moreover that richer people are more likely to be healthier, implying that within a group of individuals with the same age and gender, there may be differences in health status due to different socio-economic conditions. Income inequality is also associated with worse self-rated health (Kennedy et al., 1998).

As shown in Table 1, among the Italian regions income and age means are significantly different from each other. Consequently, the regional distribution of health status could be affected by these differences; for example, a region may show lower health status mean mainly because the age mean is higher and the income mean is lower than other regions. These differences should be taken into account when testing for equality of opportunities.

[Insert here Table 1]

Empirical evidence also shows that health status is affected by the educational level attained; see, for example, Brandolini et al. (2009). Following the theory of Grossman (1972), recent literature has focused on the relationship between health and education, showing a positive impact of education on the probability of having good health status. Healthier lifestyle seems to be more frequent among the more educated individuals. For Italy, Lucchini et al. (2009) confirm that the most relevant determinant for explaining heterogeneity in health in Italy are individual characteristics such as age, gender and education; however

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<sup>2</sup>We are aware that the latter assumption may appear quite strong, especially for epidemiologists; however, our choice was driven by the lack of information about the genetic defects’ distribution across the Italian regions. Further analysis may overcome this limitation.

significant are also differences due to the region of residence, since some of the regions in the North of Italy show better health status compared to other regions in the South. Venturini (2009) reports a significant impact on health status of economic conditions, such as falling into poverty, while the empirical analysis contained in Zucchelli (2009) reveals that in Italy health disparities are mainly linked with income inequality, low educational level, aging and employment status.

Following the discussion in Rosa Dias (2009), we can reasonably assume that education lies within individual control and thus we consider it as an effort factor.

The variable we use to measure health status is the value reported by each individual. There are some advantages and drawbacks of using a self-reported measure. According to Allison and Foster (2004), one of the advantages is that the evaluation of the relative importance of various levels of health is determined by the individuals, rather than assigned arbitrarily through a set of weights; there exists moreover empirical evidence in favor of it being a good predictor of objective indicators of health (see, among others, Idler and Benyamini, 1997; Grant, Zdzisiaw and Chappell, 1995; van Doorslaer and Jones, 2003). While objective health measures are less likely to be affected by measurement error and therefore are more reliable, subjective health status is often the only available health indicator in general-purpose survey (see Jappelli and Padula, 2003). Di Martino (2008) writes that the subjective health status is able to capture the multidimensionality of the concept of health status, conceived according to the World Health Organization as a status of complete physical, mental and social well-being.

The main drawback is constituted, on the other hand, by the qualitative nature of the health status variable, characterized by ranked modalities, such as from “very good” to “very bad” health status. As a consequence, the choice of a scale that assigns numerical values to each health category introduces arbitrariness and subjectivity. In particular, the mean of this categorical variable is highly affected by the choice of the health status values.

## 3.2 The regional model

The structure of our regional model is the following: we consider as *outcome* the conditional self-assessed health status given age, gender and income, as *circumstance* the region of residence, while *effort* is primarily constituted by health-related lifestyle (such as cigarette smoking, alcohol consumption and diet) and educational attainment.

Since effort (here, lifestyle) is unobservable, we follow Rosa Dias (2009) and assume that the average health status is monotonically increasing in effort, i.e. that healthy lifestyles have

a positive effect on health status; hence, effort becomes the residual determinant of health once types are fixed. Therefore, individuals belonging to a given quantile in the health distribution belong to the same quantile in the effort distribution within a given type. On this issue, Rosa Dias (2009) affirms that “equality of opportunity in health corresponds to a full nullification of the effect of circumstances, keeping untouched the differences in outcome that are caused solely by effort.” (p. 1059).

The model we test is the following. We consider a society having  $L$  ordered health categories  $0 < g_1 \leq \dots \leq g_L$  with  $2 \leq L < \infty$ , such that  $g_1$  stands for very good health and  $g_L$  for very bad health. We partition individuals into  $I$  income classes and into  $J$  age and gender classes (henceforth age/gender). For the latter, we follow the method used by the Italian Ministry of Health for allocating the financial resources among regions (see Table 2). This method differentiates among gender only the age class [15-44]. Hence to keep the notation simple, we use a unique partition that summarizes age and gender and that is indicated by  $j = 1, \dots, J$ . From Table 2 we note that  $J = 8$ ; in particular  $j = 1$  is the group of individuals less than 1 year old,  $j = 2, 3$  the groups with age in the intervals [1-4] and [5-14], respectively, while  $j = 4$  relates to the group of male between 15 and 44 years old,  $j = 5$  for the female between 15 and 44 years old; finally  $j = 6, 7, 8$  for all individuals with age in the intervals [45-64], [65-74], and at least 75, respectively.

[Insert here Table 2]

We denote by  $\pi_{rij}^l$  the conditional probability that an individual living in region  $r$  and belonging to income class  $i$  and to age/gender class  $j$  has health status  $l$ , that is  $\pi_{rij}^l = Pr\{\text{health} = g_l | \text{income} = i, \text{age and gender} = j, \text{region} = r\}$ , such that  $\sum_{l=1}^L \pi_{rij}^l = 1$ , for each  $i = 1, \dots, I, j = 1, \dots, J, r = 1, \dots, R$ .

We consider a set of matrices  $\mathbf{M}_{ij}$ , for each  $i = 1, \dots, I, j = 1, \dots, J$  of the conditional distributions of health, given income  $i$  and age/gender  $j$ . The matrix  $\mathbf{M}_{ij}$  is a  $R \times L$  matrix of the type

$$\mathbf{M}_{ij} = \begin{bmatrix} \pi_{1ij}^1 & \dots & \pi_{1ij}^L \\ \vdots & \ddots & \vdots \\ \pi_{Rij}^1 & \dots & \pi_{Rij}^L \end{bmatrix}_{R \times L} \quad (1)$$

where  $R = 21$  are the Italian regions. The rows represent the regions and the columns are the health levels; each cell  $\pi_{rij}^l$  is the proportion of individuals with health status  $l$  among those living in region  $r$  and having income  $i$  and age/gender  $j$ .

Matrix  $\mathbf{M}_{ij}$ , for each  $i = 1, \dots, I$  and  $j = 1, \dots, J$ , represents therefore the conditional distribution of health status over the regions for fixed age/gender and income.

There is equality of health opportunity, in this context, if for any income class and any age/gender class, the distribution of health status is the same for all regions, i.e. if each matrix  $\mathbf{M}_{ij}$  shows identical rows. Aim of this note is to test the hypothesis of equal health status distribution across regions, after adjusting for individual income and age/gender.

According to Roemer (1998), equality of opportunity in health is reached when the average health statuses are identical across types (here, across regions) at fixed levels of effort. Therefore, all those who exert the same level of effort (lifestyle) should have the same health status, regardless of their region of residence. Instead of applying directly the Roemer's model, here we follow Rosa Dias (2009) and apply the alternative definitions proposed by Lefranc et al. (2009), based on stochastic dominance.

Stochastic dominance allows the comparison of the health-related outcomes for the different circumstances. As discussed in Rosa Dias (2009), Roemer's notion of inequality of opportunity applies to individuals who, having expended the same effort, achieve different outcomes due to different circumstances; inequalities due to effort are, instead, deemed acceptable.

To this aim, let us denote by  $F_{ij}(\cdot|r)$  the conditional cumulative distribution function of health referring to region  $r$ , given income class  $i$  and age/gender group  $j$ . In particular, for each region  $r$  we construct  $I \times J$  conditional distributions of health status:  $F_{ij}(\cdot|r), i = 1, \dots, I, j = 1, \dots, J$ . Note that  $F_{ij}(\cdot|r)$  corresponds to the  $r$ -th row of the matrix  $M_{ij}$ .

We follow Lefranc et al. (2009) and Rosa Dias (2009) and properly modify the dominance criteria therein for our context.

The first definition of Equality of Opportunity (EOp) in health that we consider requires that, conditional on income and age/gender, health distribution should be the same regardless of the region of residence, i.e. for each of the  $I \times J$  groups of individuals, health distribution should be the same for all regions:

**Definition 3.1** (Strong EOp in health). *There is Strong Equality of Opportunity in Health if and only if  $F_{ij}(\cdot|r) \equiv F_{ij}(\cdot|r') \forall i = 1, \dots, I, j = 1, \dots, J$  and  $\forall r \neq r' \in \mathcal{R}$ .*

The previous definition states that if the  $I \times J$  conditional health status distributions are the same for all the regions, then health is not affected by the region of residence and only the difference in effort, that is in healthy lifestyle, explains disparities in health. This condition is, however, too stringent.

A weaker definition of EOp in health is the following: given a set  $\mathcal{R}$  of regions, we say

that there is Weak Equality of Opportunity in health if for any pairs  $r, r' \in \mathcal{R}$ , neither the conditional health distribution  $F_{ij}(\cdot|r)$  of region  $r$  dominates the conditional health distribution  $F_{ij}(\cdot|r')$  of region  $r'$  nor  $F_{ij}(\cdot|r')$  dominates to  $F_{ij}(\cdot|r)$ . Since the outcome of interest is self-assessed health, which is an ordinal variable, Rosa Dias (2009) suggests that the distributions of health conditional on different circumstances can be ordered according to first stochastic dominance (FSD). This condition is statistically testable and it can be used to assess the existence of inequality of opportunity.

**Definition 3.2** (Weak EOp in health). *There is Weak Equality of Opportunity in Health if and only if  $F_{ij}(\cdot|r) \not\prec_{FSD} F_{ij}(\cdot|r')$  and  $F_{ij}(\cdot|r') \not\prec_{FSD} F_{ij}(\cdot|r) \forall i = 1, \dots, I, j = 1, \dots, J$  and  $\forall r \neq r' \in \mathcal{R}$ .*

According to Definition 3.2, there is Weak EOp in health if none of the regions dominates another region according to the first order stochastic dominance, that is none of them shows lower health cumulative distribution functions for each of the  $I \times J$  combinations of income and age/gender than another region. Note that if the set of region  $\mathcal{R}$  satisfies the Strong EOp in health of Definition 3.1, then it satisfies also the Weak EOp in health of Definition 3.2, while the reverse is not true.

In the empirical application we perform Kolmogorov-Smirnov test procedures to check Strong and Weak EOp definitions for all possible pairs of regions  $r$  and  $r' \in \mathcal{R}$ ; in particular:

- (1) we firstly test the hypothesis of equality for each of the  $I \times J$  conditional health distributions between all pairs of regions (Definition 3.1);
- (2) we secondly test the hypothesis of first-order stochastic dominance for each of the  $I \times J$  conditional health distributions between all pairs of regions (Definition 3.2).

We say that Strong EOp in health is supported, if we fail to reject the null hypothesis in test (1) for all the  $I \times J$  conditional health distributions given age/gender and income, and for all pairs of region. Else, if we reject the null hypothesis in test (1) for at least one pair of regions, we say that there is strong inequality of opportunity in health.

We also say that there is not Weak EOp in health, if some regions are dominated, according to the first order stochastic dominance, by other regions in each of the  $I \times J$  conditional health distributions.

## 4 The data

The data set employed is the IT-SILC 2009 (Version 2009-1 dated 28-03-11), which contains the Italian data of the European Survey of Income and Living Conditions (EU-SILC).

This data set (henceforth, IT-SILC 2009) includes information on income that refers to the year 2008, while information on living conditions and on health status refers to the moment of the interview, that is the year 2009. The cash income variable considered as the baseline income for the empirical analysis is the total household disposable income, given by the sum, for all household members, of gross personal income components, gross cash benefits (self-employment, old-age, sickness, survivor, unemployment, disability), income from rental of property, education-related allowances, family or children allowances, housing allowance, interests and profits from capital investments, minus taxes on income, wealth, social insurance contributions. In order to take into account the differences in needs among households with different sizes, we apply the modified OECD scale for the disposable income.

The self-assessed health status included in IT-SILC 2009 is expressed through a variable that assigns a number to each health category: 1 for “very good health status”, 2 for “good health status”, 3 for “fair health status”, 4 for “bad health status”, 5 for “very bad health status”.

The IT-SILC 2009 sample is composed of 20,492 households and 51,196 individuals. However, health status is asked only to individuals with age 16 or more; therefore, the target population of our analysis will be individuals with 16 or more years of age living in private households with strictly positive income, that correspond to 43,636 sampled individuals.

Figure 1 depicts the distribution of health status in Italy in the year 2009 for each region. We can note relevant differences in the overall health distribution across the geographical areas.

[Insert here Figure 1]

To test for EOp we consider a small number of income classes and of age and gender classes so that the conditional probabilities  $\pi_{r_{ij}}^l$  are positive for each  $i, j$ . We divide the ordered income distribution into three parts, each containing a third of the population. The three income classes are therefore defined on the basis of the two tertiles: (i) income smaller than 12,600 euro, (ii) income between 12,600 euro and 20,084 euro, (iii) income greater than 20,084 euro. Moreover, we partition the population based on age and gender into the following groups: [16,44] male, [16,44] female, [45, 64], [65,). In order to have cells with positive frequencies in each region, we have not split further individuals with 65 or more years of age.

## 5 The results

Table 3 contains the results of the test for Strong EOp in health according to Definition 3.1: for each pair of regions, we apply 12 nonparametric Kolmogorov-Smirnov tests and check for the equality of each of the 12 conditional distributions of health given age/gender and income. In Table 3, for each pair of regions we indicate the number of conditional health distributions that are significantly equal between the two regions with “12” meaning that all the conditional health distributions are significantly equal between the two regions, while “0” stands for the fact that none of the conditional health distributions are significantly equal between the two. There is Strong EOp in health, if for all pairs of region the 12 conditional health distributions are significantly equal, i.e. if Table 3 have all cells equal to “12”. If at least one cell is different than “12”, we say that there is strong inequality of opportunity in health. The table shows that in Italy in the year 2009 there is not Strong EOp in health, since for several pairs of regions not all the conditional distributions are significantly equal. In particular, the region showing the higher number of differences with the other regions in terms of conditional health distributions is Campania: this region has only 3 conditional distributions equal to Lombardia, and only 4 equal to Veneto, Emilia Romagna, Toscana. On the contrary, for Piemonte, Valle d’Aosta, Lombardia, Emilia Romagna and Sardegna regions the Kolmogorov-Smirnov test accepts the null hypothesis of equality in all of the 12 conditional distributions, implying that for each of the groups of individuals determined by same age, gender and income the distribution of self-assessed health status is the same across these regions.

[Insert here Table 3]

Table 4 contains the results from applying the Weak EOp in health according to Definition 3.2: we conclude that there is not Weak EOp in health among the Italian regions in the year 2009, since some regions are dominated, according to the first order stochastic dominance, by other regions in all the 12 conditional health distributions.

Focusing on the special statute regions, we note that most of them show better conditional health distributions if compared to the ordinary regions, with the only exception of Sardegna. In particular, the autonomous province of Bolzano strictly FSD dominates all the other regions; in other words, for each of the given groups defined by income, age and gender the proportion of citizens declaring good health status is higher in Bolzano province than in all the other regions.

Similarly, all the conditional health distributions in the autonomous province of Trento, in Emilia Romagna and Toscana are dominated by none of the other regions (except Bolzano),

in sense that their distributions are either equal to or dominate other regions' distributions.

On the other hand, Calabria and Sardegna are stochastically dominated by most of the other regions; this means that, after controlling for income, age and gender, their citizens declare bad health status with higher frequency in comparison to many other Italian regions. This result is in line with Carrier and Bilger (2011) who found that in Calabria and Sardinia the average health outcomes is lower than in other regions, even after controlling for individual and contextual socio-economic conditions.

The results obtained are quite in line with the common expectations, with the only exception of Campania and Basilicata regions: as evident from Table 4 the conditional health distributions of these regions significantly dominate a number of other regions. The explanation of these facts lies in the groups identified by age/gender and income (the data are not shown but available from the authors upon request); for example, Campania first order stochastically dominates Valle D'Aosta, Umbria, Marche and Lazio due to a higher proportion of younger (younger than 44 years) and richer individuals (with income greater than 20,084 euro) declaring good health status. In other words, the younger and richer individuals living in Campania have a better health status than their peers living in Valle D'Aosta, Umbria, Marche and Lazio.

[Insert here Table 4]

These observations lead us to conclude that in Italy in the year 2009 there exists inequality of health opportunity, in sense that the distribution of health status conditional on age, gender and income depends not only on the individual healthy lifestyle but also on the region of residence.

## 6 Conclusion

In this note we have tested whether in Italy the probability of reaching the same health status differs by region of residence; the motivation was due to the peculiarity of the Italian health care system, which is managed mainly at the regional level. The empirical application has shown the existence of inequality of opportunity in health in Italy. In our analysis health status has been approximated by the self-assessed value; future research may involve some sensitivity analysis by replacing the subjective measure of health with objective indicators, such as presence of chronic illness or limitation in activities.

Further research may also shed light on the relationship between different distributions of health status across regions and different quality in health care provided by them. In



addition, it could be of interest an analysis of the decomposition of health inequality in Italy between fair and unfair inequality.

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Table 1: Average age and income and confidence interval, by Italian regions, year 2009.

Code	Region	AGE			INCOME		
		mean	95% Conf.Int.		mean	95% Conf.Int.	
10	Piemonte	45.3	44.5	46.1	20229	19766	20692
20	Val d'Aosta	42.9	41.3	44.4	22332	21141	23523
30	Lombardia	43.9	43.3	44.5	21331	20913	21750
41	PA Bolzano	40.8	39.5	42.2	22799	21885	23714
42	PA Trento	41.0	39.5	42.4	21073	20210	21936
50	Veneto	43.1	42.5	43.8	20140	19781	20500
60	Friuli Venezia Giulia	44.5	43.6	45.5	20210	19726	20693
70	Liguria	48.1	47.1	49.1	19824	19267	20382
80	Emilia Romagna	45.3	44.5	46.0	22882	22261	23503
90	Toscana	45.3	44.5	46.0	20711	20265	21157
100	Umbria	45.0	44.0	45.9	19229	18777	19682
110	Marche	44.3	43.4	45.2	19490	19010	19971
120	Lazio	43.2	42.5	44.0	18788	18341	19235
130	Abruzzo	43.6	42.2	44.9	16126	15300	16952
140	Molise	44.1	42.7	45.5	15644	14956	16333
150	Campania	39.9	39.2	40.6	13920	13621	14219
160	Puglia	41.2	40.4	42.1	14868	14500	15235
170	Basilicata	42.1	40.8	43.3	13712	13269	14156
180	Calabria	41.4	40.3	42.5	13614	13185	14044
190	Sicilia	41.4	40.6	42.2	13266	12926	13607
200	Sardegna	41.7	40.6	42.8	16721	16207	17236

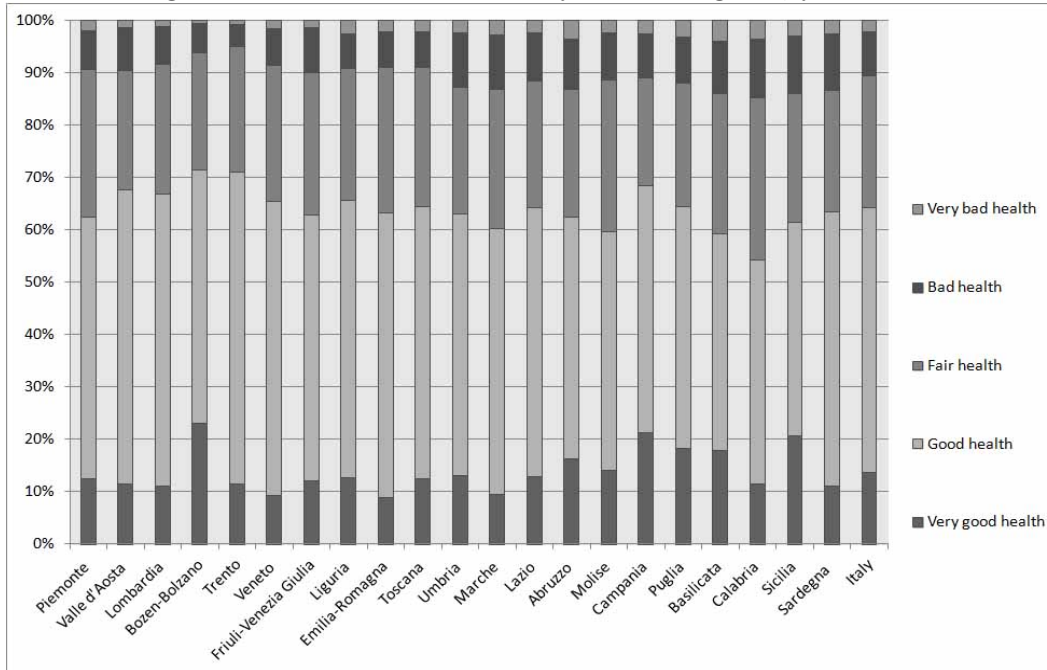
Source: Own computations from IT-SILC 2009.

Table 2: Age and gender classes.

<b>AGE &amp; GENDER CLASS <math>j</math></b>	<b>AGE (years)</b>	<b>GENDER</b>
<b>1</b>	<b>&lt; 1</b>	<b>all</b>
<b>2</b>	<b>1 to 4</b>	<b>all</b>
<b>3</b>	<b>5 to 14</b>	<b>all</b>
<b>4</b>	<b>15 to 44</b>	<b>male</b>
<b>5</b>	<b>15 to 44</b>	<b>female</b>
<b>6</b>	<b>45 to 64</b>	<b>all</b>
<b>7</b>	<b>65 to 74</b>	<b>all</b>
<b>8</b>	<b>&gt;75</b>	<b>all</b>

Source: Ministero della Salute (2006).

Figure 1: Health distribution by Italian regions, year 2009



Source: Own computations from IT-SILC 2009.

Table 3: Test for strong equality of opportunity in health given income, age and gender between Italian regions, year 2009.

Region	10	20	30	41	42	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
10		12	12	9	12	12	12	12	12	12	12	11	12	11	12	5	10	11	9	9	12	
20			12	10	11	12	12	12	12	12	12	12	12	12	12	9	10	11	9	10	12	
30				8	12	12	11	11	12	12	11	11	11	10	11	3	6	6	7	4	12	
41					11	8	10	12	8	10	11	7	9	11	10	10	11	10	8	10	5	
42						12	11	12	12	12	10	10	10	11	11	6	8	10	7	8	8	
50							12	10	12	12	11	11	12	10	12	4	6	7	8	5	12	
60								11	12	11	12	11	12	11	12	5	9	11	7	9	11	
70									11	12	12	9	12	11	11	9	10	10	7	10	9	
80										12	12	11	11	11	12	4	7	9	7	5	12	
90											12	11	12	12	12	4	10	10	7	7	10	
100												11	11	12	12	9	10	10	7	9	10	
110													11	11	11	5	8	8	12	7	12	
120														12	12	7	9	12	11	9	12	
130															12	12	12	12	10	12	11	
140																11	12	12	12	10	11	
150																	12	12	6	11	6	
160																		12	10	11	8	
170																			11	12	9	
180																				9	11	
190																					8	
200																						

Note: each cell indicates the number of conditional distributions that are significantly equal between the two regions. In particular, "12" means that all the conditional health distributions are significantly equal between the two regions, "0" means that none of the the conditional health distributions are significantly equal between the two regions (Kolmogorov-Smirnov test). For the regions' code see Table 1.

Source: Own computations from IT-SILC 2009.

Table 4: Test for weak equality of opportunity in health given income, age and gender between Italian regions, year 2009.

Region	10	20	30	41	42	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
10		SE	SE	C	SE	SE	SE	SE	SE	SE	SE	R	SE	R	SE	NO	NO	C	R	NO	SE	
20			SE	C	C	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	C	NO	R	R	C	SE	
30				C	SE	SE	C	C	SE	SE	C	R	R	NO	R	NO	NO	NO	R	NO	SE	
41					R	R	R	SE	R	R	R	R	R	R	R	R	R	R	R	R	R	
42						SE	R	SE	SE	SE	R	R	R	R	R	NO	NO	R	R	NO	R	
50							SE	C	SE	SE	C	R	SE	NO	SE	NO	NO	NO	R	NO	SE	
60								C	SE	C	SE	R	SE	R	SE	NO	NO	C	R	NO	R	
70									R	SE	SE	R	SE	R	R	NO	R	R	R	R	R	
80										SE	SE	R	R	R	SE	NO	NO	C	R	NO	SE	
90											SE	R	SE	SE	SE	NO	NO	NO	R	NO	R	
100												R	R	SE	SE	C	R	R	R	NO	R	
110													C	C	C	C	C	C	SE	C	SE	
120														SE	SE	C	NO	SE	R	NO	SE	
130															SE	SE	SE	SE	R	SE	R	
140																C	SE	SE	SE	NO	R	
150																	SE	SE	R	R	R	
160																		SE	R	C	R	
170																			R	SE	R	
180																				C	C	
190																					R	
200																						

Note: “SE” means that all the 12 conditional distributions are significantly equal between the two regions; “C” stands for the region in column FSD dominating the region in row; “R” means that the region in row FSD dominates the region in column; “NO” if none of the previous cases occurs, i.e. neither of the two regions FSD dominates the other. Kolmogorov-Smirnov test. For the regions’ code see Table 1.  
 Source: Own computations from IT-SILC 2009.