The 2008 Great Recession and Health in Italy. A Study on the Surveillance Data System PASSI.

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Sommario In the present work we study possible local/regional effects of the 2008 Great Recession utilizing data from the national Italian surveillance system PASSI (Progressi delle Aziende Sanitarie per la Salute in Italia). PASSI, adopting the behavioral risk factor surveillance (BRFS) model to the Italian context, tracks health conditions and risk behaviors across Italian regions. Here we are interested in time and context effects of some BRFS indicators. We specify a multilevel logistic model following the general form of the generalized linear mixed model (GLMM) in order to disentangle the differences of both health perception and risk behavior considering three sources of variation: individual, local and regional context effects. Results show a noticeable context effect on the main BRFS indicators.

Sommario Nel presente lavoro si studiano i possibili effetti locali/regionali della Grande Recessione iniziata nel 2008 utilizzando i dati del sistema nazionale di sorveglianza italiano PASSI (Progressi delle Aziende Sanitarie per la Salute in Italia). PASSI, adottando l'approccio delle sorveglianze sui fattori di rischio (BRFS) al contesto italiano, offre preziose informazioni, anche evolutive, sulla salute e i comportamenti a rischio in Italia. Qui siamo interessati a studiare gli effetti del tempo e del contesto su alcuni indicatori BRFS. In particolare, verrà specificato un modello logistico multilivello seguendo la forma del modello misto lineare generalizzato (GLMM) al fine di delineare le differenze sia di percezione di salute che dei comportamenti a rischio considerando tre possibili fonti di variabilità: individuali, locali e regionali. I risultati mostrano un apprezzabile effetto del contesto locale sui principali indicatori BRFS.

Key words: Great recession, behavioral risk factor surveillance, Multilevel models, Public health, Risk behaviors

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1 Introduction

The measurement of financial crisis effects on health has historically led to multiple and sometimes diverging conclusions. Notably, economic crisis affect particularly the more vulnerable peoples health – as well as their health perception– and particularly for these population strata policy intervention can be even more effective [7],[5]. In the last years, typically from 2008, the impact of the financial crisis – named great recession – became a relevant point also in the World Health Organization agenda. In 2009, WHOs Regional Committee for Europe adopted a resolution (EUR/RC59/R3) to protect and promote universal access to effective health services during economic crisis [8]. One of the most recent reports about the effects of the financial crisis in the European countries, highlighted that the health status of European citizens has been affected in a non negligible way [6]. Italy is one of the European countries most affected by the economic crisis that started to really byte perhaps some months later than in other countries, but with effects lasting also throughout the 2013. The first analysis on the effect of the crisis on the health of Italian show an increase of mental health problems, number of suicides, depression cases and substance misuse. The increase of unemployment rate was provisionally associated to nearly two hundred deaths a year [4].

In the present work we try to study possible effects of the 2008 Great Recession utilizing data from the national Italian surveillance system PASSI (Progressi delle Aziende Sanitarie per la Salute in Italia). PASSI, adopting the behavioral risk factor surveillance (BRFS, see [2] and [3] for a definition) model to the Italian context, tracks health conditions and risk behaviors across Italian regions. In particular, available data concern: individual social and demographic indicators (such as socioeconomic status); individual health behavior and individual condition perception; geographical and territorial indicators; health service access for specific subgroups of people. Data are collected each month on a random sample of resident adults aged 18 to 69 years. The response rate was higher than 80% for each year and the overall sample for the 2008-2012 years was made up of 188,070 subjects.

For the seek of brevity, here we will report only results from first analyses applied to an indicator of major interest: depression, measured by self-declared presence of some symptoms [1].

2 The PASSI data

In order to address these questions we take into account the peculiarity of Italian National Health System (INHS), which is, in many ways, federal with a relative autonomy given to each of the 19 Italian regions and 2 autonomous provinces. The stated research questions are intrinsically multilevel, i.e., factors that affect health are viewed as simultaneously operating at various levels (from individuals to regional). To investigate the effect of the great depression (i.e., time period effect) detecting the possible local differences (particularly linked to possible differences

in the local services organization and support) we will use a multilevel model for the variables of interest (specifically, health perception and the risk behavior). In particular we are interested to study the variation depending on the territorial context which is made up of two levels : *i*) LHU (Local Health Units, the elementary INHS territorial units) that account for the very local level; *ii*) Region.

The available PASSI data, a peculiar sort of national-based "big data", are made up of 188070 individuals nested in 191 LHU in 21 regions (19 regions plus 2 provinces). Data concern main health determinants and several indicators of risk factors and preventive measures. The database covers the period 2008-2012, monthly updated at LHU level.

From these data we model, in a multilevel fashion, several BRFS indicators that are directly influenced by the Great Recession. From our first analyses some variables seem to be affected negatively by the Great Recession, other are stable, and other, apparently paradoxically, show instead positive changes (e.g. the perceived health status –results not shown here– is steadily improving over the year of recession. Some authors have offered some explanations to this "strange" improvement, pointing out how economic crisis could give more leisure time available for sports and other physical activities, as well as push people to use more public transport (and walk), etc.. Nevertheless, if the overall effect could be even positive, it is, on the other hand, quite often the case that recession could affect negatively particularly selected parts of the population, typically the more vulnerable ones (and the increase in suicides seem to prove this). For all these reasons, a careful and in-depth analysis of the data is more than recommendable. Here we are discussing a first example on how to use, for these purposes, a well established source of data for an advanced analysis, reporting, as example, that applied to a relevant variable such as the (estimated) prevalence of depression.

3 Model specification and results

The proposed model allows us to disentangle the possible differences of both health perception and risk behavior. To this end, we consider three sources of variation in our model: individual, local and regional context effects. The database PASSI contains several health related variables that are collected (or transformed) on a dichotomous scale. Since we are interested in time and context effects of some interesting BRFS indicator, we specify a multilevel logistic model following the general form of the generalized linear mixed model (GLMM): $Y = \mathbf{X}\beta + \mathbf{Z}\gamma + \mathbf{e}$. In particular, for a given dummy coded BRFS variable of interest (e.g., smoke behavior, depression, alcohol consumption) we assume that its probability is associated with three level-related factors – individual, LHU, and region – via a logit link. In the following work we show the model on the depression perceived (coded: 1=depressed, 0=non-depressed) by including the following group of explanatory variables at the individual and higher levels:

- individual characteristics: SEX (dichotomous, with reference category being Fe-

male, F); AGE (continuous and centered around its mean, ranging from 18 to 69 years-old); EDU (categorical with four categories: none/elementary school, mid-, high-school, university, the latter being the reference); INCOME (categorical with three categories: low, medium, high, the latter being the reference);
- behavioral aspects: alcohol consumption; health conditions (for instance diabetes, DIAB);
- period (dummy variables for years 2008-2010, as reference, and 2011-2012);
- higher level covariates (e.g., AREA: North, as reference, Center, and South Italy).

In the whole data, disregarding LHU- region-level, we find the proportion of self-declared depressed slightly decreases from 0.07 in 2008-2010, to 0.063, in 2011-2012). In order to account for the context effects we fit a series of models in which individual-level coefficients are allowed to randomly vary across LHU- region-level. As estimation strategy, we start to fit fully unconditional models allowing only the intercept to vary across LHU- and Region-level and in order to estimate the unconditional variance components. On the basis of the full unconditional estimates we then specify several more complex models allowing variation both within intercept and slopes (with particular attention to the one related to the time period).

Given a logit link function, the unconditional model at level 1 (individuals), 2 (LHU), and 3 (region) is the following:

$$\begin{aligned} Y_{ijk} &= \beta_{0jk} + e_{ijk} \\ \beta_{0jk} &= \gamma_{00k} + u_{0jk} \text{ where } u_{0jk} \sim N(0, \tau_\beta) \\ \gamma_{00k} &= \psi_{000} + r_{00k} \text{ where } r_{00k} \sim N(0, \tau_\gamma) \end{aligned} \tag{1}$$

where: the intercept β_{0jk} corresponds to the log-odds of smoking for a reference individual in the j-th LHU of the k-th region; γ_{00k} is the average log-odds of smoking across the LHUs, while τ_β and τ_γ are the variance between LHUs and between regions in LHU region-average log-odds of smokers, respectively. The unconditional variance component estimates are $\hat{\tau}_\beta = 0.136$ and $\hat{\tau}_\gamma = 0.081$ where the one concerning the regional level were negligible. For this reason, for modeling depression outcome, a more parsimonious model can include only 2-levels, namely individual and LHU levels.

As a final stage of the stepwise procedure, the fitted final model for depression is the following (here no behavioral aspects and no higher level covariates were included in the final model):

$$Y_{ij} = \beta_{0j} + \beta_{1j} SEX_{ij} + \beta_{2j} AGE_{ij} + \beta_{3j} EDU_{ij} + \beta_{4j} INCOME_{ij} + \beta_{5j} PERIOD_{ij} + e_{ij}, \tag{2}$$

with random effects:

$$\beta_{0j} = \gamma_{00} + u_{0j}; \beta_{4j} = \gamma_{04} + u_{4j}; \beta_{5j} = \gamma_{05} + u_{5j}$$

Therefore the model assumes all β_{pj}'s to be fixed across LHUs, as γ_{p0}, where $p = 1,2,3$, except β_{0j} and income and period coefficients. In table 1 we report both the fixed effect estimates (and their significance) and the variance of the random effects.

Tabella 1 Two-level Analysis of Smoking behavior. Final model with estimates related only to significant coefficients. Standard errors are reported in brackets.

Fixed effects	**Coefficients**[a]
γ_{00}	-3.100(0.049)***
SEX (Male)	-0.691(0.020)***
AGE	0.127(0.011)***
EDU (High School)	0.162(0.035)***
EDU (Mid School)	0.361(0.036)***
EDU (Elementary/None)	0.425(0.043)***
INCOME (Medium)	0.453(0.027)***
INCOME (Low)	1.408(0.035)***
PERIOD (2011-2012)	-0.109(0.036)**
Random effects	**Variance Component**
$\tau_{u_{0j}}$	0.178
$\tau_{u_{4j}}$ (INCOME, Medium)	0.025
$\tau_{u_{4j}}$ (INCOME, Low)	0.072
$\tau_{u_{5j}}$ (PERIOD, 2011-2012)	0.094

[a]Significant parameter at: $*p < .1$, $**p < .05$, $***p < .01$.

In particular, the fixed effect of the intercept represent the log-odds of being depressed related to an average aged female, with university education level, and high income (observed in the first period 2008-2010). This fixed effect is -3.1. The associated random effects at the LHU level are depicted in fig.1 (left panel). In this plot we can appreciate that some LHUs are characterized by significant random effects values on the outcome. Regarding the other estimated coefficients, as reported in many studies, we observe the negative fixed effect for male (-0.691). The other covariates are all positively related to the log-odds of begin depressed. Of particular interest is the positive (fixed) effect of the economic status, especially the one related to the lowest category.

To appreciate random effects variability within our 2-level units, as example, we plot in fig.1 (right panel) the period (random) effect for the provinces of the Veneto region averaging the random effects associated to the LHUs within them. Here there are some differences ranging from Padua (enhanced negative period effect) to Rovigo province (almost no period effect).

In summary, the findings allow to sketch a general picture in which the source of variability at the LHU level plays a non negligible role in interpreting results. This calls attention on the direct effect of the different welfare intensity characterizing the Italian local system and could be of high interest for policy making at regional and local level.

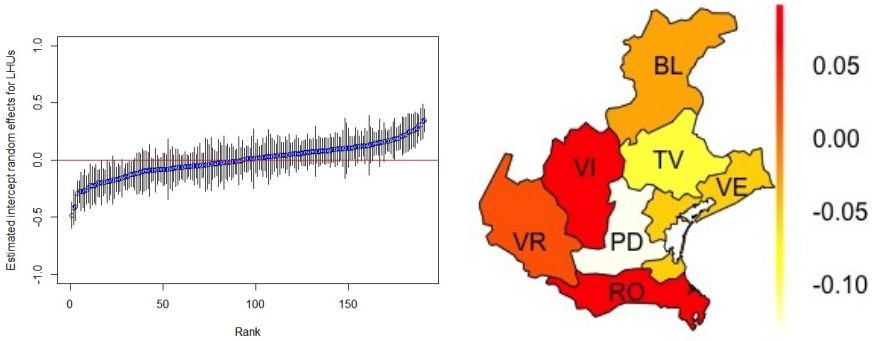

Figura 1 Graphical random effect representation: on the left panel, Random effect on the intercept for the LHU levels ordered from smallest to largest; on the right panel, random effect values (proportional to the color intensity) for the LHU of the Veneto region averaged over provinces (BL=Belluno, VE=Venice, TV=Treviso, VI=Vicenza, VR=Verona, RO=Rovigo).

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