The relationship between credit and suicide in Italy

La relazione tra credito e suicidio in Italia

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ABSTRACT

OBJECTIVES: to analyse the association between suicide rates and credit to the economy in Italy, and the potential role of social protection measures (SPMs) as buffering mechanism.
DESIGN: descriptive study.
SETTING AND PARTICIPANTS: data were derived from the Italian National Institute of Statistics and from the Organisation for Economic Co-operation and Development. Fixed-effects panel regressions were run to test the association between male and female suicide rates and the rate of growth of the credit-to-GDP (CTG) ratio. The buffering role of social protection measures was investigated. The observation period was from 1990 to 2014.
MAIN OUTCOME MEASURES: regional male and female rates of suicide.
RESULTS: male suicide rate is influenced by the rate of growth of the CTG ratio: a one-unit decrease in the latter is associated with 1.26 more suicides every 10,000 people. This marginal effect was significant at 1% for men, but not significant for women. Unemployment rate and periods of mass job loss were not associated with the outcome. With respect to SPMs, only public unemployment spending was able to moderate the association between suicide rate and rate of growth of the CTG ratio. A one-unit increase in the rate of growth of public unemployment spending was associated with 0.12 less suicides every 10,000 people, but only among men. Younger and older men were more affected by credit reduction, namely those aged 15-44 years and 75 years or more. Differently, women were not influenced by credit reduction, but only by increased UR in the group aged 55-64 years.
CONCLUSIONS: access to credit is a major determinant of psychological well-being for men, but not for women. The rate of growth of the CTG ratio may be more useful than other macroeconomic indicators at identifying the mental health outcomes of economic crises.

Keywords: suicide, credit to GDP ratio, social protection, fixed-effect panel regression, Italy

WHAT IS ALREADY KNOWN

- **Economic crises may cause negative mental health outcomes, namely increased suicides.**
- **This typically happens when the budget destined to social protection is cut.**
- **The use of unemployment rate as proxy of the business cycle led to some inconsistencies in literature.**

WHAT THIS STUDY ADDS

- **Access to credit is a major determinant of mental health in the male population.**
- **The rate of growth of the credit-to-GDP ratio is able to grasp the association between economy and mental health.**
- **Public unemployment spending moderates the negative mental health outcomes in periods with reduced access to credit.**

RIASSUNTO

OBIETTIVI: analizzare l'associazione tra tassi di suicidio e credito in Italia, e il potenziale ruolo protettivo esercitato dalla protezione sociale nei confronti delle conseguenze negative delle crisi economiche sulla salute.
DISEGNO: studio descrittivo.
SETTING E PARTECIPANTI: i dati sono stati ottenuti dall'Istituto nazionale di statistica e dall'Organizzazione per la cooperazione e lo sviluppo economico. Per studiare l'associazione tra tasso di suicidio maschile e femminile e tasso di crescita del rapporto tra credito e prodotto interno lordo (PIL), sono state impiegate regressioni panel a effetti fissi. Si è, inoltre, indagato il ruolo svolto dalle misure di protezione sociale. Il periodo di osservazione va dal 1990 al 2014.
PRINCIPALI MISURE DI OUTCOME: tassi di suicidio regionali maschili e femminili.
RISULTATI: il tasso di suicidio maschile è influenzato dal tasso di crescita del rapporto credito/PIL: una riduzione unitaria in questa variabile si associa a 1,26 suicidi in più ogni 10.000 persone. Questo effetto marginale è significativo all'1% per gli uomini, ma non per le donne. Il tasso di disoccupazione e i periodi di perdita ingente di posti di lavoro non sono risultati associati con il tasso di suicidio. Per quanto riguarda la protezione sociale, solo la spesa per i sussidi di disoccupazione è risultata in grado di moderare l'associazione tra tasso di suicidio e tasso di crescita del rapporto credito/PIL. Un aumento unitario del tasso di crescita della spesa per sussidi di disoccupazione è risultato associato a una riduzione di 0,12 suicidi ogni 10.000 persone, ma solo tra gli uomini. In particolare, gli uomini nelle fasce di età lavorative più giovani e quelli anziani sono risultati più vulnerabili, soprattutto nelle fasce d'età 15-44 anni e maggiore di 75 anni. Diversamente, le donne non risentirebbero della riduzione del credito disponibile, ma solo dell'aumento del tasso di disoccupazione nella fascia di età compresa tra 55 e 64 anni.
CONCLUSIONI: l'accesso al credito è un importante determinante di benessere psicologico per gli uomini, ma non per le donne. Il tasso di crescita del rapporto credito/PIL potrebbe risultare più utile di altri indicatori macroeconomici nell'identificare le conseguenze delle crisi economiche sulla salute mentale.

Parole chiave: suicidio, rapporto credito/PIL, protezione sociale, regressioni panel con effetti fissi, Italia

INTRODUCTION

Several systematic reviews and metanalyses addressed the topic of work and mental health in the last years, and pointed out that periods of severe economic strain may produce negative mental health outcomes, in particular increased suicides.[1-4] The relationship between work and suicides is moderated by social protection measures (SPMs), as pointed out by Stuckler et al.:[5] in the European Union member states, when the expenditure on active labour market programmes (ALMPs) exceeds USD 190 per capita, the association between unemployment and suicides vanishes. In Italy, where a mean expenditure on ALMPs of USD 125 per capita was calculated, a long-run association between unemployment and suicides was reported.[6,7]

Despite several studies reporting negative health outcomes in times of financial strain, there are some inconsistencies, in literature, especially with respect to mortality due to suicides,[8-26] which may be due to the following reasons. First, rates are frequently affected by unit root features, that may generate spurious associations between variables included in ordinary least squares (OLS) regressions. A possible way to overcome this limitation is to adopt co-integration techniques among the levels of the variables of interest or to use variables induced to be stationary, for example using their rate of growth.[6,27] A second reason is represented by the main macroeconomic indicator included in the analysis. The majority of studies used unemployment rates (URs) to describe labour market dynamics, while a minority included other indicators, e.g., long-term unemployment rate (LTUR), consumers' confidence, Gross Domestic Product (GDP) per capita, etcetera. It is known that LTUR is strongly associated with increased risk of suicide, particularly in the first five years after job loss, and that this risk can persist for up to 16 years.[28] Therefore, the choice to use a certain macroeconomic indicator may influence the outcomes of the research.[29] A third reason that can potentially explain the inconsistencies in literature is that frequently the analyses were not adjusted for SPMs, despite the latter may moderate the relation between work and suicides.[5,30] The fourth and final reason is that UR and LTUR may not properly describe the situation of some categories of people, such as entrepreneurs, discouraged workers, etcetera. Therefore, a macroeconomic indicator able to grasp what potentially happens to *all* workers would be helpful.

The purpose of this paper is to model suicide rate using the rate of growth of the credit-to-GDP (CTG) ratio (a proxy of the degree of financialisation of the economy) to overcome the above-listed limitations. The CTG ratio is proposed in the empirical literature as a measure of the credit cycle[31,32] and it is an indicator of future financial instability.

Credit represents the volume of loans in a country; it is modelled as a function of its main macroeconomic determinants (i.e., GDP growth, interest rate, and credit-to-GDP ratio gap; the latter describes the gap between the observed CTG ratio and its equilibrium level). Being expressed as a ratio to GDP, the CTG ratio is normalized by the size of the economy: this facilitates international comparison, hence its usefulness.[33] As pointed out by Dembiermont et al., credit is crucial for economics.[34] Families borrow money necessary for their expenditures, for example to buy a house. Companies borrow money to finance investments. The level of indebtedness of the private sector has consequences for the economic policies, since it influences the mechanism of transmission of monetary politics and it is an important factor able to influence the financial stability. In fact, it is known that severe systemic crises in the bank sector are preceded by increased accumulation of credit in the private sector.[34]

To the Authors' knowledge, no previous study has yet investigated the relationship between suicidal behaviour and credit cycle in Italy. Being a rate of growth of levels, the rate of growth of the CTG ratio has also an interesting quality: it is smoother than the other proxies of the credit cycle (e.g., the simple credit growth calculated as difference in log-levels). This smoothness accounts for a better correlation with the business economic cycle at short and medium frequencies. In other words, the rate of growth of the CTG ratio better captures the link between the financial cycle and the real economic fluctuations. Hence, in the present study, this indicator is used as an alternative to the UR, which is a proxy for the economic cycle as well, though liable to produce inconsistent results. Changes in this ratio may be able to reflect the distress and discomfort felt due to credit reduction or credit crunch during recessive episodes. The aim was to assess the relationship between credit to the economy (proxied by the rate of growth of the CTG ratio) and suicide rates. The role of SPMs was also investigated as potential buffering mechanism.

The focus on Italy has the following reasons:

1. Italy was severely hit by the economic and health consequences of the Great Recession (2008-2009) and the following Sovereign Debt Crisis (2010-2014);[35-39]

2. despite this, the amount of research on the impact of these economic shocks on the health of the Italian population is not comparable to what was produced in other countries;

3. Italy was frequently included in European panels studies, producing results that were not disaggregated by country;

4. to the Authors' knowledge, no previous study investigated the association between rate of growth of the CTG ratio and mental health outcomes in Italy.

All this should be considered in the light of the Covid-19 pandemic that hit the world in the early 2020. Italy was the first European country to face this emergency and to adopt full lockdown measures to protect the health of

the population. On the one hand, such measures made it possible to contain the epidemic; on the other hand, they caused a severe drop in consumes, thus provoking the most severe drop in GDP since World War II. Access to liquidity, by means of credit and redundancy funds, was proposed as key-element to face the economic crisis which began during the lockdown. Yet, the high levels of indebtedness of Italy jeopardized the capability to provide a quick and appropriate response to the need of liquidity of families and companies, especially when compared to other European countries, such as Germany.[40,41]

METHODS

STUDY DESIGN AND DATA COLLECTION

Standardized regional suicide rates for men and women (per 10,000 people) were collected from the Health for All database (version: December 2018) powered by the Italian National Institute of Statistics (Istat), available at: https://www.istat.it/it/archivio/14562. This indicator represents the number of regional suicides occurred yearly, divided by the regional population, per 10,000. Since data referred to years 1990-2014, the latter represented the observation period of this study.

The UR was collected from the website of Istat. Data were derived from a quarterly survey carried out by Istat, based on a sample made up of 250,000 families living in about 1,400 municipalities (corresponding to a sample size of about 600,000 people, representative of the Italian population). More information concerning the survey may be found here: https://www.istat.it/it/archivio/8263.

National data concerning credit to the economy (in euros) were retrieved from De Bonis and Silvestrini.[32] This variable is constructed using bank loans to the private sector (i.e., households and non-financial corporations) and to the public sector. The CTG ratio was then calculated dividing credit by national GDP in euros, retrieved from the Bank of Italy at the following link: https://www.bancaditalia.it/statistiche/tematiche/stat-storiche/stat-storiche-economia/index.html This is a proxy for liquidity in the economic system.

SPMs were found on the website of the Organization for Economic Co-operation and Development (OECD) at the following link: https://data.oecd.org. The expenditure for ALMPs, public unemployment spending (PUS), and aggregated social protection (SP) were collected all per head at current prices and adjusted for purchasing power parity, in USD. ALMPs include "spending on public employment services and administration, labour market training, special programmes for youth when in transition from school to work, labour market programmes to provide or promote employment for unemployed and other people (excluding young and disabled people), and special programmes for disabled people";[5] PUS includes "cash expenditures to people compensating for unemployment. This expenditure includes redundancy payments from public resources and pensions to beneficiaries before they reach so-called standard pensionable age if these payments are made because they are out of work or otherwise for reasons of labour market policy"[5]; SP is an aggregate measure that includes housing projects, interventions aiming to support families, ALMPs, PUS, and health interventions.[5]

ECONOMETRIC FRAMEWORK

To address the research question, a panel regression with fixed effects by OLS was estimated. The specification is as follows:

$$Y_{i,t} = \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_2 P_t + \beta_3 time + \beta_4 \text{'mass job loss'} + \alpha_i + u_{i,t} \quad \text{Eq. (1)}$$

where: $i = 1, \ldots, 20$

$i = 1, \ldots, 20$ is the cross-sectional dimension of the panel representing the 20 Italian regions;

$t = 1, \ldots, 24$ is the time dimension of the panel that ranges from 1990 to 2014;

$Y_{i,t}$ is the suicide rate at regional level;

X_{1t} is the rate of growth of the CTG ratio at national level, which represents the rate of growth of the liquidity in the economic system;

X_{2t} represents the changes in the national UR;

P_t represents the rate of growth of different SPMs (i.e., ALMPs, PUS, and SP). Using the rate of growth of these nominal variables reduces the problem of spurious results in the regressions;

Time captures the decreasing trend in the suicide rate;

'mass job loss' is a dummy variable that identifies periods of mass job loss, in line with previous research,[5] it is equal to 1 in the periods featured by a change in regional UR greater than two standard deviations, 0 elsewhere;

$\alpha_{i,t}$ are the fixed effects capturing unobservable regional heterogeneity, in other words, omitted variables that change across regions but remain constant in the time span of the analysis (e.g., different social capital, political institutions, family structure and local labour markets, and features and facilities of psychiatric services, that may affect regional suicide rates).

Results were deemed significant when at least a 5% significant level was reached.

ETHICS

All data were anonymized, aggregated at the origin and in the public domain: therefore, Ethics Committee's approval was not necessary. The guidelines governing research from the Declaration of Helsinki were followed.

RESULTS

All variables used in this study are shown in table 1. There is a noticeable age-gradient among both men and women, with suicide being more prevalent in older age-groups. Among men, the prevalence was three-four times greater than among women. Such differences are in line with national figures and interanational literaure, as further discussed.

With respect to the dummy variable *'mass job loss'*, it was equal to 1 in the following years and regions: in 1993 in Trentino-Alto Adige, in 2009 in Lombardy and Emilia-Romagna, in 2012 in Val d'Aosta, Lombardy, Veneto, Emilia-Romagna, Umbria, Marche, Abruzzo, Calabria, Sicilia, in 2013 in Apulia. Only the 2.7% of Italian regions experienced mass job loss in the observation period of this study. Notably, in 1993, when a severe economic crisis occurred, only one region (the 5% of all regions in that year) presented mass job loss; differently, in 2009 the 10% and in 2012 the 45%. Therefore, the job outcomes of the two crises (i.e., the 1993 economic crisis and the post-2008 economic crisis) were different in terms of magnitude.

The results of the regression analysis carried out according to Eq. (1) are displayed in tables 2 and 3. Table 2 shows the association between suicides rates in men and women and the growth rate of the CTG ratio, adjusted for time trend, UR, periods of mass job loss, and SPMs. The decreasing trend in the past decades for the regional suicide rates for both men and women is noticeable. The rate of growth of the CTG ratio affected the suicide rate among men: a one-unit reduction of this variable (though representing a theoretical scenario) was associated with 1.26 more suicides per 10,000 people. This marginal effect was significant at 1% for men, but not significant for women. UR and periods of rise mass in UR were not associated with suicide rates.

With respect to SPMs, social expenditure for unemployment was able to moderate the association between sui-

VARIABLE	MEAN	STANDARD DEVIATION	OBSERVATIONS (n.)
DEPENDENT VARIABLE: SUICIDE RATES (x10,000 PEOPLE)			
MEN			
Total	1.25	0.48	500
0-14 years old	0.02	0.06	500
15-24 years old	0.67	0.46	500
25-34 years old	1.03	0.62	500
35-44 years old	1.14	0.61	500
45-54 years old	1.36	0.70	500
55-64 years old	1.62	0.82	500
65-74 years old	2.09	1.08	500
75 years old or more	3.63	1.87	500
WOMEN			
Total	0.36	0.15	500
0-14 years old	0.01	0.03	500
15-24 years old	0.16	0.18	500
25-34 years old	0.24	0.20	500
35-44 years old	0.34	0.27	500
45-54 years old	0.44	0.32	500
55-64 years old	0.52	0.40	500
65-74 years old	0.58	0.36	500
75 years old or more	0.66	0.52	500
EXPLANATORY VARIABLES			
National per capita real Gross Domestic Product (in euros), reference 2010	21,911	5,128	500
National Credit to GDP (CTG)	0.79	0.17	500
National unemployment rate (people seeking jobs as % of the total labour force), men and women	9.34	1.74	500
National expenditure on active labour market programmers, in US dollars, per capita	125.69	50.06	500
National expenditure on public unemployment spending, in US dollars, per capita	249.96	183.35	500
National expenditure on social protection, in US dollars, per capita	6816.00	2110.00	500

NOTES

The number of observations for each variable collected is 500, since it refers to the 20 Italian regions observed for 25 years (1990-2014). These variables were used to run the panel regressions, in which the dependent variable was first the standardized suicide rate disaggregated only by gender, then disaggregated by age. For every dependent variable referring to suicide rate, the overall number of observations is always 500. Suicide rate for men and women refer to the standardized suicide rate, not disaggregated by age. / *Il numero di osservazioni per ogni variabile raccolta è 500, dal momento che si riferisce alle 20 regioni italiane osservate per 25 anni (1990-2014). Queste variabili sono state utilizzate per effettuare le regressioni panel in cui la variabile dipendente era costituita in primis dal tasso di suicidio standardizzato e disaggregato solo per genere, quindi disaggregato anche per età. Per ognuna delle variabili dipendenti riferibili al tasso di suicidio il numero complessivo di osservazioni è sempre 500. I suicide rate per uomini e donne sono il tasso di suicidio standardizzato, non disaggregato per età.*

Table 1. Descriptive statistics on the variables used in the analysis, years 1990-2014.
Tabella 1. Statistiche descrittive delle variabili utilizzate nell'analisi, anni 1990-2014.

	SUCIDE RATE MEN	SUCIDE RATE WOMEN
Constant	23.57* (5.91)	11.09* (2.21)
Time	–0.01* (0.003)	–0.01* (0.001)
Growth of the credit-to-GDP ratio	–1.26* (0.34)	–0.13 (0.15)
Δ national unemployment rate	0.02 (0.02)	0.01 (0.01)
Periods of mass job loss	–0.02 (0.04)	–0.03 (0.03)
Growth of the expenditure on active labour market programmes	0.19 (0.11)	0.02 (0.03)
Growth of the expenditure on public social expenditure	–0.05 (0.30)	0.25 (0.19)
Growth of the expenditure on public unemployment spending	–0.12* (0.04)	–0.08 (0.05)
LSDV R-squared	0.81	0.58
Effect of the rate of growth of the CTG ratio on the relative change in suicide rate	101%	36%

In brackets, robust standard errors (HAC) / *In parentesi, errori standard robusti (HAC);* ***** 1% significance level / *livello di significatività al 1%*; **CTG:** credit-to-GDP ratio / *rapporto credito-PIL*

NOTES. The null hypothesis (the groups have a common intercept, i.e., fixed effects equal to zero) is always rejected. / *L'ipotesi nulla (che i gruppi abbiano una intercetta comune, cioè che gli effetti fissi siano uguali a zero) è sempre rifiutata.*

'Periods of mass job loss' is a dummy variable equal to 1 in years when changes in regional unemployment rate are higher than two standard deviations, 0 elsewhere / *La variabile 'Periods of mass job loss' è una dummy che ha valore 1 negli anni in cui la variazione del tasso di disoccupazione regionale è maggiore di due deviazioni standard, 0 diversamente*

The effect of the rate of growth of the CTG ratio on the relative change in suicide rate was calculated by multiplying the mean suicide rate (displayed in table 1) during the observation period of the study per the coefficient of the growth of the CTG ratio displayed in the table / *L'effetto del tasso di crescita del rapporto credito-PIL sulla variazione relativa del tasso di suicidio è stato calcolato moltiplicando la media del tasso di suicidio (mostrato in tabella 1) durante il periodo di osservazione dello studio per il coefficiente del tasso di crescita del rapporto credito-PIL mostrato in tabella*

Table 2. Credit, social protection, and suicide rates. Ordinary least squares fixed effects estimation. Main dependent variable: suicide rate (number of suicides per 10,000 people per year). The analysis is adjusted for time trend, national unemployment, periods of mass job loss, expenditure on active labour market programmes, on public unemployment spending and overall public spending on social protection. Number of observations: 480.
Tabella 2. Credito, protezione sociale e tassi di suicidio. Stime dei minimi quadrati con effetti fissi. Variabile dipendente principale: tasso di suicidio (numero di suicidi per 10,000 persone all'anno). L'analisi è aggiustata per: trend temporale, tasso di disoccupazione nazionale, periodi di disoccupazione di massa, spesa per politiche attive del lavoro, sussidi di disoccupazione e spesa complessiva per la protezione sociale pubblica. Numero di osservazioni: 480.

	SUICIDE RATE						
	15-24	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**	**75+**
CONSTANT							
Men	31.78* (7.48)	31.17* (6.14)	24.05 (13.42)	12.16 (10.48)	56.11* (8.21)	91.05* (17.69)	170.91* (21.51)
Women	6.48* (1.99)	12.97* (2.73)	4.48 (4.27)	0.59 (3.97)	27.60* (2.66)	30.00* (6.37)	30.00* (6.37)
TIME							
Men	–0.02* (0.04)	–0.02* (0.003)	–0.01 (0.01)	–0.01 (0.01)	–0.01* (0.004)	–0.04* (0.01)	–0.08* (0.01)
Women	–0.003* (0.001)	–0.01* (0.001)	–0.002 (0.002)	0.00001 (0.02)	–0.01* (0.001)	–0.01* (0.003)	–0.03* (0.003)
PERIODS OF MASS JOB LOSS							
Men	0.02 (0.09)	–0.12 (0.20)	–0.07 (0.14)	0.05 (0.15)	0.06 (0.15)	0.16 (0.15)	–0.22 (0.24)
Women	0.01 (0.04)	–0.01 (0.05)	0.09 (0.07)	–0.15 (0.11)	–0.15 (0.08)	–0.04 (0.07)	–0.01 (0.07)
GROWTH OF THE CREDIT-TO-GDP RATIO							
Men	–1.18** (0.42)	–1.17* (0.49)	–2.25** (0.85)	0.01 (0.04)	–0.95 (1.05)	–1.07 (1.00)	–4.50* (1.52)
Women	0.07 (0.21)	–0.31 (0.38)	–0.80 (0.56)	0.04 (0.30)	0.25 (0.71)	–0.25 (0.46)	0.12 (0.61)
Δ NATIONAL UNEMPLOYMENT RATE							
Men	–0.01 (0.02)	0.05 (0.03)	0.01 (0.03)	–2.34 (1.67)	0.07 (0.04)	0.002 (0.05)	–0,04 (0.11)
Women	0.02 (0.01)	–0.003 (0.01)	–0.03 (0.03)	0.03 (0.02)	0.04* (0.01)	0.01 (0.02)	0.03 (0.02)
LSDV R-SQUARED							
Men	0.33	0.32	0.44	0.46	0.53	0.51	0.51
Women	0.06	0.16	0.18	0.22	0.21	0.18	0.42
EFFECT OF THE RATE OF GROWTH OF THE CTG RATIO ON THE RELATIVE CHANGE IN SUICIDE RATE							
Men	174%	114%	197%	1%	59%	51%	124%
Women	44%	129%	235%	9%	48%	43%	18%

In brackets, robust standard errors (HAC) / *In parentesi, errori standard robusti (HAC)* ****** 5% significance level / *livello di significatività al 5%;* ***** 1% significance level / *livello di significatività al 1%;* **CTG:** credit-to-GDP ratio / *rapporto credito-PIL*

NOTES. The null hypothesis (the groups have a common intercept, i.e., fixed effects equal to zero) is always rejected. / *L'ipotesi nulla (che i gruppi abbiano una intercetta comune, cioè che gli effetti fissi siano uguali a zero) è sempre rifiutata.*

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The effect of the rate of growth of the CTG ratio on the relative change in suicide rate was calculated by multiplying the mean suicide rate (displayed in table 1) during the observation period of the study per the coefficient of the growth of the CTG ratio displayed in the table / *L'effetto del tasso di crescita del rapporto credito-PIL sulla variazione relativa del tasso di suicidio è stato calcolato moltiplicando la media del tasso di suicidio (mostrato in tabella 1) durante il periodo di osservazione dello studio per il coefficiente del tasso di crescita del rapporto credito-PIL mostrato in tabella*

Table 3. Credit and suicide rates, disaggregated by age and gender. Ordinary least squares fixed effects estimation. Main dependent variable: suicide rate (number of suicides per 10,000 people per year). The analysis is adjusted for time trend, national unemployment, and periods of mass job loss.
Tabella 3. Credito e tassi di suicidio, disaggregati per età e genere. Stime dei minimi quadrati con effetti fissi. Variabile dipendente principale: tasso di suicido (numero di suicidi per 10.000 persone all'anno). L'analisi è aggiustata per trend temporale, tasso di disoccupazione nazionale e periodi di disoccupazione di massa.

cide rate and rate of growth of the CTG ratio. A one-unit increase in the rate of growth of PUS was associated with 0.12 less suicides every 10,000 people. For women, the marginal effect was not significant.

Table 3 presents the estimated effect on suicides rates of the rate of growth of the CTG ratio, stratified by age and gender. Younger and older men were more affected, namely those aged 15-44 years and 75 years or more. No association was noticeable with respect to UR and periods of mass job loss. Among men aged 15-24 years, a one-unit reduction in the rate of growth in the CTG ratio was associated with 1.18 more suicides every 10,000 people; similarly, among men aged 25-34 years it was associated with 1.17 more suicides every 10,000 people. Among men aged 35-44 years, a one-unit reduction in the rate of growth in the CTG ratio was associated with 2.25 more suicides every 10,000 people. Finally, among men aged 75 years or more, it was associated with 4.50 more suicides every 10,000 people.

With respect to suicidal behaviours, women did not seem to be influenced by the access to credit, but only by periods of economic crisis featured by increased UR. This association was noticeable among women aged 55-64 years. In this group, a one-unit increase in the variation of UR was associated with 0.04 more suicides every 10,000 women.

DISCUSSION

In this study, credit reductions were associated with increased suicides, with gender specificity (i.e., only among men) consistently with previous research.[7;38,39,42,43] This may be due to the fact that in Italy men were more affected by economic difficulties than women, especially in the first years of the post-2008 economic crisis.[5,43-46] Therefore, access to credit may be a major determinant of psychological well-being for men, but not for women.

Among SPMs, only PUS was able to buffer the negative outcomes of decreased credit availability, in terms of increased suicides. This result is consistent with previous research,[6,7] suggesting that other measures, such as ALMPs, are not effective in Italy, differently than in other European countries,[5] where they proved to be able to reduce suicides. As previously suggested, a lack of adequate funding might explain this result, with respect to ALMPs.[6] On the other hand, the fact that PUS is able to buffer the negative mental health outcomes of credit reductions (among men, but not among women) reinforces the finding that credit is a major determinant of mental health among men. In fact, unemployment benefits provide money that may be spent for everyday and work life needs, similarly to private credit provided by banks, though to a different extent.

Among the male population, the highest effect size was noticeable in the group of men aged 75 years or more. At first sight, this might appear striking; in fact, it might be hypothesized that access to credit represents a problem of younger individuals. Yet, it is possible that this result is in relation with the following epidemiological evidence: the older the age, the higher the odds of suicide.[47] Also, when compared to younger men, this age group frequently lacks work (especially in terms of identity and social role) and family (a higher proportion is widow, other may have lost friends or live far from children), and it is often featured by chronic and debilitating diseases, that may be accompanied by psychological suffering. On the other hand, it should be noted that the effect of credit availability on the relative change in suicide rate among men aged 75 years or more was in line with what observed in younger age groups; moreover, this effect was the highest among men aged 35-44 years, followed by the group aged 15-24 years. In other words, in the first period of their working life, young men might be more affected by decreased credit availability, which may help them realize their work and family life.

The fact that suicide is mainly a male phenomenon, as stemmed out by the present analysis, is well known.[47] Differently, since – to the Authors' knowledge – no previous study investigated the association between CTG ratio and suicide, the result found in this paper were compared to the results obtained in studies that involved macroeconomic indicators different than credit, generally UR. With respect to Italy, several studies suggested that, in the years following the 2008 Great Recession, suicides increased possibly due to the deterioration of macroeconomic conditions.[6,38,39,42] The reduction of credit occurred in the same years, at least partly consequent to the implementation of an anti-crisis legislation based on austerity,[48] may have worsened the effect of the recession on suicidal behaviours.

The results here presented are consistent also with previous international research.[1-3] Yet, it could be noted that this analysis failed to identify an association between suicides and UR, except for women aged 55-64 years. This is actually not surprising. On the one hand, the CTG ratio may be more sensitive than UR at detecting such an association. On the other, as anticipated in the "Introduction" paragraph, inconsistent results were found in literature when UR was used as main macroeconomic indicator. Here, the results suggest that, rather than the condition of unemployment per se, it is the lack of money to be associated with severe mental health outcomes, namely suicides. When UR increases and money is available thanks to credit provided by the bank system or unemployment benefits provided by the State, the risk of suicide is lower.

Durkheim's theories may help explain these findings concerning the link among suicide, credit, and SPMs. In his landmark essay on suicide, he pointed out that periods of financial instability might be accompanied by a state of reduced social norms and regulations, called *anomie*, able to increase self-harm.[49] Theoretically, two forces may oppose such increased anomie to restore a sort of social homeostasis. The first are SPMs, since the individual expects that in times of uncertainty, the State will provide help. Yet, when the individual faces economic difficulties, and the State reduces the support (e.g., because of austerity), one

force able to counterbalance anomie vanishes and the risk of suicide increases.

A second force is the bank system. When the individual, not necessarily unemployed, is in financial strain, the expectation is that the bank system will provide help by means of credit. This expectation may even increase in times of financial bubble, due to greater availability of credit. The individual and the bank system have a sort of reciprocal pact: the person brings money to the bank (e.g., the wage) and expects that the bank may help him/her in case of need. Yet, when the individual needs credit, and this need is not addressed, another force able to counterbalance anomie vanishes.

In both cases, some features of everyday life that are perceived as part of the routine vanish, thus threatening the individual's ontological security, which is based on routine and predictability.[50] Moreover, both State and banks are institutions, which suggests that poor trust between the latter and the individuals, i.e., reduced social capital, may be a risk factor for suicide. It is known that social capital is able to exert a protective effect against psychiatric disorders, namely depression, but only up to a certain extent.[51] The rate of growth of the CTG ratio might be conceived as a proxy of social capital: when it reduces, it is no longer able to exert its protective function.

The main strength of this study is represented by the use of CTG ratio as main macroeconomic indicator. Yet, the present study has several limitations that need to be acknowledged. First, its observational nature does not permit any conclusion concerning causality. Also, for the present study, longitudinal secondary data were collected, but the Authors were not able to assess their quality. Yet, the study design made the research feasible and produced findings consistent with previous studies; in addition, data were collected from official statutory agencies with high quality assurance standards and reputation.

Second, it is known that rates may be non-stationary unit root processes, which limits their inclusion in ordinary least square regressions. To overcome this, the rate of growth of the CTG ratio that is stationary in variance were used, and the suicide rate on a time trend were regressed, thereby obtaining trend-stationary series.

Third, since CTG ratio was measured at country level and did not vary across regions, the panel regression analysis may have inflated the number of observations, thus producing low standard errors. Mortality estimates were shown to be sensitive to the level of geographic aggregation.[52] Therefore, this analysis might be affected by a type I error, and the association between explanatory variables and outcome might be overestimated and partly biased. Future time-series studies, and full regional panel analysis are currently on the research agenda of the Authors to overcome such limitations.

Fourth, it should be noted that a one-unit reduction in the rate of growth of the CTG ratio represents a theoretical scenario: an increase (or decrease) smaller than one-unit is more likely. Yet, suicide rates were standardized per 10,000 people, thus even a small increase in the rate of growth of the CTG ratio may produce important outcomes at the population level. Moreover, despite the entity of the effect size, this study showed a clear association between credit to the economy and self-harm behaviours, particularly among men. Fifth and final, the relationship between the rate of growth of the CTG ratio and suicides in Italy was investigated; other European countries were not included in the analysis, since important differences exist among European countries with respect to welfare, access to credit, economic growth, and epidemiology of psychiatric disorders. Further research is needed to test the validity of the present findings and assumptions in other countries.

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REFERENCES

1. Margerison-Zilko C, Goldman-Mellor S, Falconi A, Downing J. Health impacts of the Great Recession: a critical review. Curr Epidemiol 2016;3(1):81-91.
2. Martin-Carrasco M, Evans-Lacko S, Dom G, et al. EPA guidance on mental health and economic crises in Europe. Eur Arch Psychiatry Clin Neurosci 2016;266(2):89-124.
3. Frasquilho D, Gaspar Matos M, Salonna F, et al. Mental health outcomes in times of economic recession: a systematic literature review. BMC Public Health 2016;16:115.
4. Dom G, Samochowiec J, Evans-Lacko S, Wahlbeck K, Van Hal G, McDaid D. The impact of the 2008 economic crisis on substance use patterns in the Countries of the European Union. Int J Environ Res Public Health 2016;13(1):122.
5. Stuckler D, Basu S, Suhrcke M, Coutts A, McKee M. The public health effect of economic crises and alternative policy responses in Europe: an empirical analysis. Lancet 2009;374(9686):315-23.
6. Mattei G, Pistoresi B, De Vogli R. Impact of the economic crises on suicide in Italy: the moderating role of active labor market programs. Soc Psychiatry Psychiatr Epidemiol 2019;54(2):201-08.
7. Mattei G, Pistoresi B. Unemployment and suicide in Italy: evidence of a long-run association mitigated by public unemployment spending. Eur J Health Econ 2019;20(4):569-77.
8. Ruhm CG. Are recessions good for your health? Q J Econ 2000;115(2):617-50.
9. Ruhm CJ. Good Times Make You Sick. J Health Econ 2003;22(4):637-58.
10. Ruhm CJ. Healthy Living in Hard Times. J Health Econ 2005;24(2):341-63.
11. Ruhm CJ. Commentary: mortality increases during economics upturns. Int J Epidemiol 2005;34(6):1206-11.
12. Ostamo A, Lönnqvist J. Attempted suicide rates and trends during a period of severe economic recession in Helsinki, 1989-1997. Soc Psychiatry Psychiatr Epidemiol 2001;36(7):354-60.
13. Dehejia R, Lleras-Muney A. Booms, Busts, and Babies' Health. Q J Econ 2004;119(3):1091-130.
14. Neumayer E. Recessions lower (some) mortality rates: evidence from Germany. Soc Sci Med 2004;58(6):1037-47.
15. Gerdtham UG, Ruhm CJ. Deaths rise in good economic times: evidence from the OECD. Econ Hum Biol 2006;4(3):298-316.
16. Tapia Granados JA. Recessions and Mortality in Spain, 1980-1997. Eur J Population 2005;21:393-422.
17. Nandi A, Prescott MR, Cerdà M, Vlahov D, Tardiff KJ, Galea S. Economic conditions and suicide rates in New York City. Am J Epidemiol 2012;175(6):527-35.
18. McInerney M, Mellor JM. Recessions and seniors' health, health behaviors, and healthcare use: analysis of the Medicare Current Beneficiary Survey. J Health Econ 2012;31(5):744-51.

19. McInerney M, Mellor JM, Nicholas LH. Recession depression: mental health effects of the 2008 stock market crash. J Health Econ 2013;32(6):1090-104.
20. Saurina C, Bragulat B, Saez M, Lopez-Casasnovas G. A conditional model for estimating the increase in suicides associated with the 2008-2010 economic recession in England. J Epidemiol Community Health 2013;67(9):779-87.
21. Oskarsson H, Bjarnadóttir S. Suicides and the economic crisis: the Icelandic experience. Eur Psychiatry 2013;28(S1):1.
22. Fountoulakis KN, Koupidis SA, Siamouli M, Grammatikopoulos IA, Theodorakis PN. Suicide, recession, and unemployment. Lancet 2013;381(9868):721-22.
23. Miret M, Caballero FF, Huerta-Ramirez R, et al. Factors associated with suicidal ideation and attempts in Spain for different age groups. Prevalence before and after the onset of the economic crisis. J Affect Disord 2014;163:1-9.
24. Gordon S, Sommers BD. Recessions, Poverty, and Mortality in the United States: 1993-2012. Am J Health Econ 2016;2(4):489-510.
25. Argys LM, Friedson AI, Pitts MM. Killer Debt: The Impact of Debt on Mortality. Federal Reserve Bank of Atlanta Working Paper Series 2016. Working Paper 2016-2014 November 2016.
26. Cavicchioli M, Pistoresi B. Unfolding the relationship between mortality, economic fluctuations, and health in Italy. Eur J Health Econ 2020;21(3):351-62.
27. Ceccherini-Nelli A, Priebe S. Economic factors and suicide rates: associations over time in four countries. Soc Psychiatry Psychiatr Epidemiol 2011;46(10):975-82.
28. Milner A, Page A, LaMontagne AD. Long-term unemployment and suicide: a systematic review and meta-analysis. PLoS One 2013;8(1):e51333.
29. Crost B, Friedson A. Recessions and health revisited: New findings for working age adults. Econ Hum Biol 2017;27(Pt A):241-47.
30. Stuckler D, Basu S. The body economic. London: Allen Lane; 2013.
31. Borio C. The financial cycle and macroeconomics: what have we learned and what are the policy implications? In: Nowotny E, Ritzberger-Grünwald D, Backé P (eds). Financial Cycles and the Real Economy. Cheltenham Glos: Edward Elgar Publishing; 2014; pp. 10-35.
32. De Bonis R, Silvestrini A. The Italian financial cycle: 1861-2011. Cliometrica 2014;8(3):301-34.
33. European Central Bank. Financial Stability Review December 2006.
34. Dembiermont C, Drehmann M., Muksakunratana S. Il nuovo database BRI per il credito totale al settore privato non finanziario. BRI Corpus ID: 169650777. March 2013.
35. De Vogli R, Marmot M, Stuckler D. Excess suicides and attempted suicides in Italy attributable to the great recession. J Epidemiol Community Health 2013;67(4):378-79.
36. De Vogli R. Unemployment and suicides during the recession in Italy. BMJ 2013;347:f4908.
37. Mattei G, Ferrari S, Pingani L, Rigatelli M. Short-term effects of the 2008 Great Recession on the health of the Italian population: an ecological study. Soc Psychiatry Psychiatr Epidemiol 2014;49(6):851-58.
38. Odone A, Landriscina T, Amerio A, Costa G. The impact of the current economic crisis on mental health in Italy: evidence from two representative national surveys. Eur J Public Health 2018;28(3):490-95.
39. De Vogli R, De Falco R, Mattei G. Excess suicides due to the global economic crisis in Italy: an update. Epidemiol Prev 2019;43(2-3):111.
40. Mutti A. Occupational Medicine in the time of COVID-19. Med Lav 2020;111(2):83-86.
41. Gaglione C, Purificato I, Rymkevich OP. COVID-19 and Labor Law: Italy. Italian Labour Law e-Journal. 2020;13(1S). doi: 10.6092/issn.1561-8048/10767
42. Starace F, Mungai F, Sarti E, Addabbo T. Self-reported unemployment status and recession: an analysis on the Italian population with and without mental health problems. PLoS One 2017;12(4):7-10.
43. Theodossiou I. The effects of low-pay and unemployment on psychological well-being: a logistic regression approach. J Health Econ 1998;17(1):85-104.
44. Giovannini E. Documento di Programmazione Economico-Finanziaria relativo alla manovra di finanza pubblica per gli anni 2010-2012. Audition of the President of the Italian National Institute of Statistics. Rome: Istat; 2009. Available from: https://www.istat.it/it/files/2011/01/TestoAudizione2.pdf (last accessed: 18.03.2020).
45. Fiori F, Rinesi F, Spizzichino D, Di Giorgio G. Employment insecurity and mental health during the economic recession: an analysis of the young adult labour force in Italy. Soc Sci Med 2016;153:90-98.
46. Eurostat. Unemployment statistics. 2019. Available from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Unemployment_statistics (last accessed: .01.03.2019).
47. Crestani C, Masotti V, Corradi N, Schirripa ML, Cecchi R. Suicide in the elderly: a 37-years retrospective study. Acta Biomed 2019;90(1):68-76.
48. Pizzoferrato A. The economic crisis and labor law reform in Italy. IJCLLIR 2015;31(2):187-205.
49. Durkheim E. On Suicide. London: Penguin Classics; 2006 (Original version: 1897).
50. Giddens A. Modernity and Self-Identity. Redwood City (CA; USA): Stanford University Press; 1991.
51. Economou M, Madianos M, Peppou LE, Souliotis K, Patelakis A, Stefanis C. Cognitive social capital and mental illness during economic crisis: a nationwide population-based study in Greece. Soc Sci Med 2014;100:141-47.
52. Lindo JM. Aggregation and the estimated effects of economic conditions on health. J Health Econ 2015;40:83-96.