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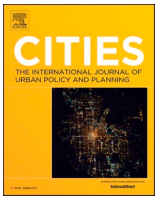

Life satisfaction in the time of COVID-19. The frog effect

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ABSTRACT

Besides the physical and mental health problems it brought, the COVID-19 pandemic impinged on economic and social aspects of people's lives, threatening economic security and interpersonal relationships, aspects that are major determinants of perceived subjective well-being. We investigate the relationship between individual life satisfaction, and relational and material goods under the exceptional circumstance of the pandemic and lockdown in Italy. Unlike other studies, this paper examined whether COVID-19 infection and deterioration of economic and relational circumstances caused by COVID-19 can predict changes in individual life satisfaction, controlling for other contextual factors. The results suggest that the pandemic threatened the life satisfaction of respondents and the main predictor of this deterioration was related to the effect of the pandemic and lockdown on social relations. Aspects like gender, type of city and dwelling also emerged to be important predictors of LS. These findings have implications for social policies and urban planning, and offer additional insight in the research on LS.

1. Introduction

The SARS-CoV-2 virus (known also as COVID-19) appeared in 2020 and has since spread all over the world (WHO, 2022). Italy was one of the countries hardest hit. In March 2020, it entered a very hard national lockdown, which continued for 2 months. In the months that followed, many regions of the country experienced new lockdowns. The COVID-19 pandemic had a heavy impact on physical and psychological health (Brooks et al., 2020; Prati & Mancini, 2021). It also affected the structure and quality of people's lives, threatening emotional balance and life satisfaction (Greyling et al., 2021; Helliwell et al., 2021).

Since the first cases of COVID-19 (Wuhan, China, December 2019), much information has become available and many studies on the causes and effects of the pandemic on physical and mental health have been published (Horbach, 2020; Zhang et al., 2020). Due also to data gathering problems, less attention was devoted to the impact of the pandemic on individual life satisfaction and the factors that most impinged on it. The COVID-19 pandemic was an exceptional "natural experiment" in which to investigate these issues and verify hypotheses and results emerging from previous "out of crisis" studies.

Empirical research has shown that life satisfaction varies directly with GDP in the short run. This relationship does not hold in the long run, and variations in subjective well-being are better predicted by other variables, like social capital (Bartolini & Sarracino, 2014; Easterlin, 2017). However, theoretical and empirical studies have shown that economic growth produces a change in the "consumption pattern", shifting choices from public to private goods. This has detrimental effects on individual satisfaction (Bartolini & Bonatti, 2008; Sarracino & Bartolini, 2015), leading to what Scitovsky called the "joyless economy" (Scitovsky, 1976), as if people, through a sequence of apparently innocuous choices, unconsciously slip into a boredom routine, where material capital is meant to compensate for shrinking social capital. But what happens if they suddenly receive a stimulus, as may occur in a crisis?

According to the well-known "boiling frog metaphor", a frog placed in boiling water will immediately jump out, but if the water is initially tepid and is slowly brought to boiling, the frog will not realize the danger and will slowly die. The pandemic was certainly the equivalent of "boiling water" for people and society. They were suddenly placed in a dramatic situation and are still trying to jump out.

The COVID-19 pandemic was a situation in which some aspects of people's lives (health, economic, social) were (and still are) badly threatened by widespread contingent phenomena, where feelings of insecurity gained the upper hand. It certainly modified individual and family habits and threatened lives and relationships, especially in the lockdown period (Helliwell et al., 2021). In fact, the uniqueness of this

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period lies not only in the magnitude and deathly effects of the coronavirus outbreak, but also in the public health and social measures, like lock-downs, implemented to reduce its spread and impact.

The aim of this paper was to investigate people's reactions to a sudden unexpected threat to their lives and sense of security, aspects that they took for granted. The COVID-19 pandemic enabled research in a "real world" situation rather than a hypothetical framework, or to use Thaler and Sunstein (2008)'s categories, in a hot as opposed to a cold state. During dramatic events, people may appraise aspects of their lives differently: "reference values may change and what people really care about may come to the fore more spontaneously" (Bimonte et al., 2022, p. 1).

Drawing on some studies on the impact of the global financial crisis of 2008 (Clench-Aas & Holte, 2017; Eurofound, 2014; Helliwell et al., 2014), this paper examined whether COVID-19 infection (caught by the respondents or their relatives) and deterioration of economic and relational circumstances caused by COVID-19 (as reported by the interviewed) can predict changes in individual life satisfaction,[1] controlling for other contextual factors. Unlike other studies, we investigated these aspects in terms of variation rather than level. Accordingly, it addresses the following main research questions:

Q1. Did the COVID-19 pandemic impinge on individual life satisfaction?
Q2. If so, which of the investigated period-specific aspects (aforementioned) are the most reliable predictor of the decline in perceived life satisfaction?

To investigate these issues, we implemented a web-survey in April 2021, i.e. one year after the outbreak of COVID-19, when the social and economic consequences had displayed their effects. A snowball sampling procedure was used to collect data and Ordinal Logit Regression models were implemented.

The paper is organized as follows. Section 2 introduces a literature review, mainly to contextualize the research in the reference field of investigation and evidence its differences and originalities. Section 3 describes data, sampling method and shortly discusses the theoretical framework and the statistical methodology used. Section 4 discusses the results, trying to interpret them within the findings of the reference literature. Finally, main conclusions are reported in Section 5.

2. Determinants of individual life satisfaction: an essential literature review

2.1. Individual life satisfaction and income

The literature on the determinants of life satisfaction or happiness is extensive.[2] The most debated aspect is the relationship between economic growth and individual life satisfaction, although recent empirical and experimental research has shown that other important factors also affect individual happiness.[3]

As Easterlin (1974) first pointed out, at macro level life satisfaction and per capita income move together until a country reaches a certain stage of development; then, the relationship becomes weak or vanishes (Easterlin, 2003; Easterlin et al., 2010). It seems that beyond a certain point, life satisfaction becomes insensitive to additional income, due to an adaptation process (DeLeire & Kalil, 2010; Di Tella & MacCulloch, 2010; Vendrik, 2013). This stylized fact emerges for European countries (Clark et al., 2008) as well as United States (Layard, 2005). However, subjective wellbeing varies across countries (Helliwell et al., 2021) as well as the point at which additional income ceases affect well-being (Jebb et al., 2018). In a recent paper, Easterlin argues that the relationship between income and subjective well-being varies with the economic situation (expanding vs contracting economy), because the benchmark for income appraisal change: comparison is made with the income of others in the course of economic growth, and with one's past income during a crisis (Easterlin, 2023). Using longitudinal data, Moro-Egido et al. (2022) analysed the relationship between variations in economic and social situation and changes (improvement or decline) in subjective well-being for German people. In line with these empirical results, researchers suggest that, though relevant, income does not influence individual life satisfaction in a long-term perspective and other factors need to be considered.

2.2. Main correlates of individual life satisfaction

Many studies have examined the correlations between socio-demographic, institutional and contextual variables (e.g. social relationships, social capital, trust, quality of public services, equity) and subjective evaluation of life (Ahmadiani et al., 2022; Blanchflower & Oswald, 2004a; Frey & Stutzer, 2000a; Frey & Stutzer, 2000b; Helliwell, 2003; Veenhoven, 2000; Prayitno et al., 2022). Some of these factors prove to have a clear-cut influence on subjective well-being, while others show an equivocal relationship.

For example, education affects individual life satisfaction directly as well as indirectly through the higher income, the social relationships and the social status that education can provide (Cuñado & de Gracia, 2012; see also Di Tella et al., 2001; Meeks & Murrell, 2001; Murrell et al., 2003; Stevenson & Wolfers, 2008). Other studies report a non-significant effect (Ahmadiani et al., 2022; Helliwell, 2003; Inglehart et al., 2000) which may depend on the fact that other factors, such as income, health, and trust, may already capture the effect of education (Helliwell, 2003). The same indefinite effect is shared by variables such as gender (Ahmadiani et al., 2022; Stevenson & Wolfers, 2009) and age (Blanchflower, 2021).

Other contextual and situational factors have been shown to be determinants of well-being. For example, various studies have detected a positive impact of health on happiness (Helliwell et al., 2017; Lyubomirsky et al., 2006; Taylor et al., 2006). This relationship seems particularly true in the case of perceived health rather than objective data on health (Okun & George, 1984; Watten et al., 1997). A positive correlation has also been detected for other environmental and situational contexts, such as job satisfaction, living conditions and social relationships (Frey & Stutzer, 2005). Empirical research has consistently shown that progressive erosion of relational goods is detrimental to individual life satisfaction. Relational goods and sociability play an important role in fostering happiness (Becchetti et al., 2008; Becchetti & Rossetti, 2009; Helliwell & Putnam, 2004; Portela et al., 2013).

Economic researchers postulate that the erosion of social capital is an effect of changes in "consumption patterns" (a shift from public to private goods) caused by economic growth: people buy material goods to compensate for declining social capital (Bartolini & Bonatti, 2008; Sarracino & Bartolini, 2015). According to Kasser (2002), materialistic values undermine various aspects of life, reducing people's ability to enjoy things, and consequently their happiness (for a review see Tsang et al., 2014). An aspect that helps explain this phenomenon is social comparison (Frey & Stutzer, 2002). Economic growth entails that

[1] It is worth noting that social relations are one of the three dimensions of social capital (Putnam, 2000). Therefore, according to Tuominen and Haanpää (2022), a person is well-off in terms of social capital if she/he sustains good relationships with family, friends, and acquaintances; considers other people generally trustworthy; and provides help to others and receives help from them with ease. This is why it happens that social capital and social relations are used interchangeably.

[2] The overlap of terms like life satisfaction, happiness, etc. is not universally accepted, because of their different inherent meanings. However, in empirical research they are normally used interchangeably. Given the aim of this paper, we conform to the latter practice.

[3] Given the aim of our paper, we only consider essential references. For a recent and wider literature review, see for example, Clark (2018), Frey (2018), and Milovanska-Farrington and Farrington (2022).

consumption has an increasingly social aspect, so that "the satisfaction that individuals derive from goods and services depends in increasing measure not only on their own consumption but on consumption by others as well" (Hirsch, 1976, p. 2). This means that not only the absolute level of income and wealth matters, but also an individual's relative position (Ferrer-I-Carbonell, 2004), a concept that dates back to Veblen (1899). This effect is stronger in competitive settings and the more comparison is observable. At the same time, psychological factors connected with ideology and faith may moderate or reinforce it, as maintained by Diener and Seligman (2004).

2.3. Individual life satisfaction in time of crisis

With few exceptions, research on the determinants of life satisfaction has been carried out in "normal" times. But what happens to the value system when things change substantially? Sarracino and Piekałkiewicz (2021) and Clench-Aas and Holte (2017) analysed whether an exogenous shock, such the financial crisis of 2008, that impinged on relational goods and income, changed people's points of view and modified the relationship between income, social capital and happiness. Similarly, Helliwell et al. (2014) investigated whether the social fabric of a community may explain its capacity to react to different types of crisis. They showed that the higher the social capital and trust endowment, the better the response. Eurofound (2014) analysed changes in quality of life across the EU for different types of households, especially families with children, because children are at higher risk of poverty and social exclusion.

Likewise, the World Happiness Report 2021 investigated the effects of another type of exogenous shock, namely the COVID-19 pandemic. It reported that the pandemic had a heavy impact on people's emotions more than on their life satisfaction (Helliwell et al., 2021). Certain aspects of people's lives (health, economic, social) have been threatened by widespread contingent phenomena, where feelings of insecurity gain the upper hand. The pandemic certainly modified individual and family habits and threatened lives and relationships, especially in the lockdown period.

Bimonte et al. (2022) conducted a survey during the lockdown period. Their aim was not to analyse satisfaction with aspects of individual life, but to explore factors that people believe contribute most to subjective well-being, on the assumption that the pandemic was a dramatic event that may modify people's reference values. Those who declared that COVID-19 had primarily jeopardized their interpersonal relationships were significantly more likely to report lower levels of subjective well-being. According to respondents, social capital and interpersonal relationships were important determinants of life satisfaction.

While much information is now available on the pandemic and its impact on physical and mental health, its impact on individual life satisfaction and people's emotions has been relatively less investigated, due also to the nearness of the event and data gathering problems. In the authors' opinion, these aspects are worthy of further attention. Drawing on the above literature concerning the impact of exogenous shocks on individual life satisfaction, we therefore investigated these aspects and report our results in the following sections.

3. Research design and method

3.1. Sampling and procedure

Considering the limits imposed in the pandemic period (no face-to-face interviews) and lack of resources, we administered the questionnaire by online survey using Google Forms,[4] a type of online data collection that has become reliable and, therefore, widely used (Reynolds et al., 2006). Participants were recruited by sending the web link via WhatsApp, using an exponential non-discriminative snowball sampling method (Etikan et al., 2016). In certain frameworks, this approach is effective, extends the geographic range and reaches persons with specific traits or visiting barriers, like sick people (Baltar & Brunet, 2012).

The recruitment started with four seeds (group of contacts). The initial seeds were encouraged to share the survey with other contacts. Before starting, interviewees were told that the survey was confidential and anonymous, and informed about the study goal and its non-commercial nature. To minimize the number of incomplete questionnaires and to make the results more reliable, the questions were concise and focused on the aspects the research was interested in. The survey was conducted in April 2021.[5]

3.2. Study site

Initial participants (seeds) were recruited in two places: three seeds at the University of Siena, a small town in central Italy, and one at the University of Naples *Parthenope* in southern Italy. The main reason for this choice was heuristic, i.e. selecting two very different social and urban settings to test whether the impact of period-specific aspects on life satisfaction was mediated by contextual variables.

Siena and Naples represent very different environments: the former is an inland town in Tuscany, the latter a coastal city in Campania (Fig. 1). Apart from their different geographical locations and size, they differ in cultural and historical attributes, together with some major social and economic factors, as indicated in Table 1. They also differ in term of organisation and quality of healthcare services (Cicchetti & Gasbarrini, 2016; OECD, 2015), with an evident and persistent regional gap, especially between Northern and Southern regions, in the performances of hospitals (Barra et al., 2022). Notwithstanding, no relevant difference can be detected with respect to the effects of COVID-19 in Tuscany and Campania (Blangiardo et al., 2020).

The previous characteristics allowed testing for differences in response in relation to setting. The copious group of contacts that researchers had in these two locations helped in maximizing the number of contacts and answers, making the survey more reliable.

3.3. Survey questionnaire and variables

The questionnaire was designed to include various closed-ended questions and it was organized in three different sections. Following a now common and accepted procedure (Cummins & Gullone, 2000; Frey & Stutzer, 2002; OECD, 2013; Van Praag, 2007; Veenhoven, 2007), respondents were first invited to assess their satisfaction with life on a 11-point Likert scale ranging from 0 (unhappy) to 10 (very happy). Then, they were asked to retrospectively assess their life satisfaction before the pandemic on the same scale.[6]

In Fig. 2 we reported the sample distribution of life satisfaction before (LS_{t-1}) and during (LS_t) the COVID-19 pandemic. Considering the aim of the paper, we computed a new variable (y) as difference between LS_{t-1} and LS_t. To account for potential outliers, we winsorized the variable y, capping it at the 1st percentile below and the 99th percentile above. From the winsorized distribution of y, we derived a new ordinal variable (ΔLS) that assumes a value of zero if y was equal to or <0 (this indicates no difference between LS_{t-1} and LS_t or that LS_t was greater than

[4] In 2020, even Gallup World Polls modified its world polling method from face-to-face to telephone interviews.

[5] The flow chart of methodology research is reported in Figure A1 in the Appendix.

[6] This type of measurement has been used and validated in numerous studies, countries and official sample surveys (see, for instance, the 2018 ad-hoc module on subjective well-being, which is part of the European Union's statistics on income and living conditions (EU-SILC survey)).

Fig. 1. Geographical location of Siena and Naples.

Table 1
Some data on Siena and Naples.

	Siena	Naples
Income pc euro (2019)*	25,057	19,797
Employment rate (15–64 year age range)°	75.17 %	43.69 %
Unemployment rate (15–64 year age range)ˆ	4.5 %	21 %
Population (2023)ˆ	52,812	913,462
Area (km^2)ˆ	118.53	119.02
Population density (km^2)ˆ	446	7674
Average household sizeˆ	2.03	2.46
Mean ageˆ	48.15	43.65
Old age indexˆ	251.8	152.6

Source: *INTWIG (Data Intelligence Company) - https://www.intwig.it/.
°Il Sole24 Ore (Economic and financial newspaper of record) - https://www.infodata.ilsole24ore.com/.
ˆISTAT (Italian National Institute of Statistics) - http://dati.istat.it/.

LS_{t-1})[7] and positive values when LS_t was greater than LS_{t-1}. The sample distribution of ΔLS is reported in Table 2. This distribution ranges between 0 (no differences) and 4 (the largest differences): the higher the values the higher the difference in (worsening of) life satisfaction.

In the second section of questionnaire, interviewees were asked to assess whether and to what extent certain COVID-19-related impacts had affected their lives. In particular, they were invited to evaluate how much the pandemic had affected their income and personal relations on a 4-point scale ranging from "not at all" (none) to "a lot" (large)[8] and to declare whether they, or close relatives, had had COVID-19. Regarding this latter, the assumption was that people would be more worried or would perceive a stronger effect on their satisfaction if they or their relatives were infected with COVID-19.

The third section of the questionnaire contained questions aimed at recording the socio-demographic characteristics of respondents, the type of dwelling they lived in and the city of residence. The main

[7] [7] We treated negative values as zero since our focus was solely on predicting the factors that contributed to decrease life satisfaction during the COVID-19 period.

[8] As for changes in income and social relations conditions, interviewees were invited to answer these questions respectively: "Could you tell us to what extent the pandemic impacted on your or your family income?", and "Could you tell us to what extent the pandemic impacted on your social relationships?".

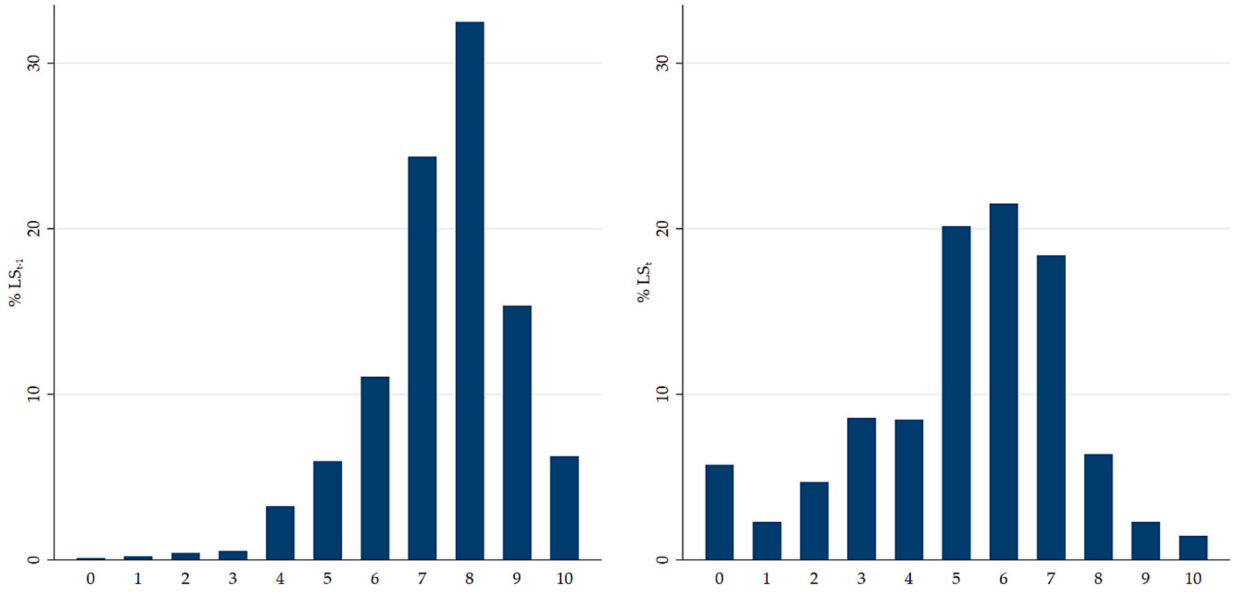

Fig. 2. Sample distribution of life satisfaction before (LS_{t-1}) and after (LS_t) the COVID-19 pandemic.

Table 2
Sample distribution of Δ*LS*.

Δ*LS*	n	%
0 no differences	181	19.34
1	139	14.85
2	228	24.36
3	167	17.84
4 (the largest differences)	221	23.61

Table 3
Main characteristics of the sample (descriptive statistics).

Area	Siena	Naples	Other	All
N (%)	526 (56)	129 (14)	281 (30)	936 (100)
Average age (sd)	40 (0.68)	36 (1.36)	36 (0.87)	38 (0.51)
Level of education %				
Up to secondary	58.9	64.3	43.8	55.1
University or post graduate	41.1	35.7	56.2	44.9
Gender %				
Male	30.6	36.4	35.9	33.0
Female	69.4	63.6	64.1	67.0
Civil status %				
Married	73.0	69.8	71.5	72.1
Single	27.0	30.2	28.5	27.9
Working condition %				
Working	61.8	45.7	52.7	56.8
Student	27.2	48.1	40.2	34.0
Out of labour force	11.0	6.2	7.1	9.2
Dwelling type%				
Countryside	21.7	6.2	10.3	16.2
City, suburb with garden	31.0	23.3	31.7	30.1
Other	47.3	70.5	58.0	53.7
COVID-19 Infection %				
No	43.5	38.0	42.7	42.5
Yes	56.5	62.0	57.3	57.5
Impact on social relations (%)				
None	0.4	0.8	1.4	0.8
Small	11.0	8.5	13.9	11.5
Moderate	41.5	48.8	42.3	42.7
Large	47.1	41.9	42.4	45.0
Impact on income (%)				
None	24.0	27.1	28.5	25.8
Small	43.9	38.8	40.9	42.3
Moderate	24.1	27.1	21.4	23.7
Large	8.0	7.0	9.2	8.2

descriptive statistics of all the variables included in second and third section of the questionnaire are reported in Table 3.

3.4. Empirical approach

In a normative perspective, as life satisfaction (*LS*) studies normally are, information is gathered on what makes a person satisfied to a certain degree with life. We can assume that *LS* is a latent variable influenced by different factors for which the following relation holds:

$$LS = f(x_i, \beta_i)$$

where *x* and β are the predictors and the parameters, respectively. In our study, we assumed that the COVID-19 pandemic impinged on subjective well-being. Our aim was to investigate whether people shifted to a lower level of subjective wellbeing during the pandemic and what factors predicted it best. Specifically, as explained above, we examined the dependence between changes in the level of life satisfaction (*ΔLS*) and variations (deterioration) in economic and social conditions caused by COVID-19, and whether or not respondents or a family/household member caught COVID-19, controlling for other personal and contextual variables. Therefore, our theoretical model can be specified as follows:

$$\Delta LS_i = f(I_i, P_i, \beta,) \quad (1)$$

where ΔLS_i is the variation in *LS* (difference between life satisfaction at *t*-1, before COVID-19, and *t*, today) of individual *i*; βs are the parameters to estimate; I_i is the vector of change in individual *i*'s income, personal relations, and health, intended as whether or not a person or relative caught COVID-19; P_i is a vector of personal and contextual characteristics (sex, age, education, civil status, dwelling type, working conditions, city of residence).

Considering the ordinal nature of the response variable (ΔLS_i) the best strategy to empirically implement Eq. (1) was an Ordered Logit regression model (McKelvey & Zavoina, 1975; Winship & Mare, 1984). This model is defined by a set of *C*-1 equations where the logit of cumulative probability of the response variable ΔLS_i with *C* categories is assumed to be a linear function of covariates X_i whose regression coefficients β remain constant across response categories. This is known as the proportional odds hypothesis (Kleinbaum & Klein, 2010).

In detail, our ordered logit model for the ordinal response ΔLS_i with $C = 5$ categories (from 0 to 4) is defined by a set of four (*C*-1) equations, where the cumulative probabilities $g_{ci} = Pr(\Delta LS_i \leq c | x_i)$ are related to a

linear predictor $\beta' x_i = \beta_1 x_{1i} \ldots + \beta_k x_{ki}$ through the logit function:

$$logit(g_{ci}) = log(g_{ci}/(1 - g_{ci})) = \alpha_c - \beta' x_i \quad (2)$$

where $c = 1,2, \ldots,4$, α_c are the cut-point parameters and x_i is a vector of covariates. The coefficients represent the estimated increase in the log odds of the response variable per unit increase in the value of the predictors. The exponential function of the regression coefficients exp(β′) are the odds-ratio (OR) associated with a one unit increase in the independent variable, i.e. the impact that a change in the predictor has on the likelihood of improving (worsening) the scores of the response variable (Agresti, 1980). The impact depends on the starting (baseline) value of the predictor and the values of the other covariates (Long & Freese, 2006). Likelihood ratio (LR) tests were then done to compare the goodness of fit of different nested models (Whittaker & Furlow, 2009).

4. Results and discussion

4.1. Sample characteristics and descriptive analysis

Table 3 shows the main characteristics of the sample.[9] A total of 936 subjects, 627 females (67 %) and 309 males (33 %), mean age 38 years, was recruited. With respect to these aspects, no major differences emerged between the cities. Most respondents were from Siena (56 %) and about 45 % had a bachelor's degree or higher. Most (57 %) were employed, although this number varied considerably between areas. This employment figure reflects the current economic situation in the two cities.

The answers showed that >57 % of the sample or their relatives or close friends had been infected with COVID-19. In line with current data, this figure was higher in Naples. Almost 9 out of 10 declared that the pandemic had considerably or moderately damaged their social relations and about 1/3 stated that it considerably or moderately reduced their income. These results are quite similar to those of the similar analysis by Bimonte et al. (2022) in spring 2020, when the economic effects of COVID-19 had not yet completely emerged. After one year of the pandemic, the impact on the Italian economy was huge.[10] In the statistical model, it is worth mentioning that we combined the categories of these two last variables, namely impact on income and impact on social relations, into two levels. Specifically, we grouped "large" with "moderate" and "small" with "none." As a result, for model estimation, we employed two dummy variables. These variables are assigned a value of 1 if the impact is high and 0 otherwise.

Table 4
Descriptive statistics of LS_{t-1} and LS_t.

	N	Min	Max	Mean	sd	Median
Siena						
LS_{t-1}	526	1	10	7.39	1.40	8
LS_t	526	0	10	5.16	2.16	5
Naples						
LS_{t-1}	129	2	10	7.47	1.63	8
LS_t	129	0	10	4.90	2.11	5
Other cities						
LS_{t-1}	281	2	10	7.52	1.43	8
LS_t	281	0	10	5.42	2.09	6

Note: the values presented in this table are derived from the winsorized dataset.

Table 4 report the descriptive statistics of LS_{t-1} (left panel) and LS_t (right panel) in the three areas, respectively. The data showed a deterioration of life satisfaction in all areas.

4.2. Regression results

Table 5 displays the estimated coefficients obtained from ordinal logistic regression models with varying specifications. The eight columns display the estimates of distinct nested ordinal logit models. The first two only include our main variables, those that were likely immediately threatened by COVID-19 pandemic, i.e. social relations, income and COVID-19 infection.

In line with the "boiled frog" metaphor, we were interested in understanding how people reacted to the COVID-19 pandemic which threatened important aspects of their lives. We endeavoured to estimate whether material or immaterial aspects of individual lives, threatened by the pandemic, were more related to the reduction in life satisfaction detected after one year of COVID-19. We also tested for a city effect, to see whether personal, cultural, urbanistic, societal or economic conditions (as proxied by city of residence) mediated the relationship.

Other models were simply an enlargement of the above specifications. They encompassed additional personal and status covariates that have been found related to LS. Table 6 shows the Likelihood Ratio (LR) tests carried out to compare and select different model specifications (Whittaker & Furlow, 2009). According to the model selection technique used, model (7) was the one that best fit the data. Table 7 presents the coefficient estimates and respective odds ratios for this specific model. The first three rows show the effect of what we considered the main direct drivers of variation in *LS*, i.e. deterioration of the economic situation and social relations, and having or not caught the COVID-19 infection, all included in the model as dummy variables. The results definitely show that the impact of the COVID-19 pandemic on social relations (and presumably the ensuing concern) was a clear and main predictor of deteriorating satisfaction with life. Regardless of the model specification, the impact of this variable was always significant, and its magnitude was the greatest of all covariates. It turned out to be important per se. Indeed, this result did not even change when we considered the interaction effect between "impact of COVID-19 on social relations" and "city of residence". The latter variable was not significant.

In model 7 (see Table 7) respondents who reported that the pandemic affected their social life "a lot" (large impact) or "enough" (moderate impact) had a higher probability of reporting a higher Δ*LS* (a decline of life satisfaction). In other words, other things being equal, the probability of reporting a greater difference in levels of *LS* before and during the pandemic was >2.6 times higher for those whose social relations were greatly or considerably altered.[11] This probability ranged from more that 3 (=exp(1.1)) in the first model to about 2.6 in the last.

As regards the relation between "impact of COVID-19 on income" and "deterioration of life satisfaction" things are a little more articulated. This variable was significant only in models where we did not consider its interaction with city of residence. Both variables ("city of residence" and "COVID-income") turned out not to be significant once we considered their interaction effect. Therefore, the city and income effect did not emerge per se. This is consistent with current data, i.e. the different economic, societal and public service structure of Siena compared to other areas, especially Naples. One must consider that Siena is a very particular city: it is small, historic and quite wealthy with a very strong shared local culture, represented by the Palio. This cultural event is not just a famous horse race but a way of life. The city is divided into 17 contradas (city wards), each with a fair level of solidarity

[9] Because of the non-probability sampling used, figures cannot be considered representative of the reference population.

[10] The dataset is available on demand.

[11] This means that a shift in the independent binary variable "impact on social life" from 0 (none or small) to 1 (moderate or large) multiplies the probability of reporting a greater decline in life satisfaction (difference between life satisfaction before and during the COVID-19 pandemic) by 2.6.

Table 5
Ordinal logit *Regression results*.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Impact on income	0.34***	0.34***	0.12	0.34***	0.13	0.06	0.03	0.06
(None/small = baseline)	(0.13)	(0.13)	(0.17)	(0.13)	(0.17)	(0.17)	(0.17)	(0.17)
Impact on social relations	1.1***	1.09***	1.07***	1.29***	1.27***	0.95***	0.96***	0.96***
(None/small = baseline)	(0.18)	(0.18)	(0.18)	(0.25)	(0.25)	(0.19)	(0.19)	(0.19)
Infected or knowing people with COVID-19	0.04	0.03	0.03	0.02	0.01	0.06	0.1	0.09
(None = baseline)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Area (*Siena* = *baseline*)								
Naples		0.39**	0.16	0.5	0.36	0.19	0.19	0.13
		(0.17)	(0.21)	(0.56)	(0.56)	(0.22)	(0.22)	(0.22)
Other cities		−0.08	−0.21	0.37	0.22	−0.18	−0.2	−0.23
		(0.13)	(0.16)	(0.37)	(0.38)	(0.16)	(0.16)	(0.16)
Interaction effects								
Impact on income #Naples			0.72*		0.72*	0.84**	0.83**	0.79**
			(0.38)		(0.38)	(0.39)	(0.39)	(0.39)
Impact on income #other			0.42		0.41	0.49*	0.51*	0.49*
			(0.29)		(0.29)	(0.29)	(0.29)	(0.29)
Impact on social relations #Naples				−0.12	−0.23			
				(0.59)	(0.59)			
Impact on social relations #other				−0.51	−0.49			
				(0.39)	(0.4)			
Gender						0.62***	0.59***	0.58***
(Male = baseline)						(0.13)	(0.13)	(0.13)
Age (continuous)						0.01	0.001	0.01
Education						(0.01)	(0.01)	(0.01)
(No degree = baseline)						−0.01	0.03	0.02
						(0.12)	(0.12)	(0.12)
Single						0.49***	0.43***	0.43***
(Not single = baseline)						(0.14)	(0.15)	(0.15)
Children						0.01	0.05	0.05
(No children = baseline)						(0.2)	(0.2)	(0.2)
Working condition (*work* = *baseline*)								
Student							0.16	0.19
							(0.18)	(0.18)
Out of labour force							0.69***	0.7***
							(0.22)	(0.22)
Dwelling type (*countryside* = *baseline*)								
City, suburb with garden								0.26
								(0.19)
Other								0.35**
								(0.18)
Observations	936	936	936	936	936	936	936	936
Pseudo R^2	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04

Standard errors are in brackets, cut-off estimates have been deleted for simplicity.
*** $p < .01$.
** $p < .05$.
* $p < .1$.

Table 6
Likelihood ratio test results.

Comparisons	LR statistics	*p*-Value
Model 2 vs Model 1	LR chi2(2) = 6.43	0.0401
Model 3 vs Model 2	LR chi2(2) = 4.68	0.0952
Model 4 vs Model 2	LR chi2(2) = 1.71	0.4259
Model 5 vs Model 3	LR chi2(2) = 1.55	0.4597
Model 6 vs Model 3	LR chi2(2) = 37.05	<0.0001
Model 7 vs Model 6	LR chi2(2) = 10.52	0.0052
Model 8 vs Model 7	LR chi2(4) = 4.05	0.1322

between *contradaioli* (citizens of the ward). Neighbourhood relationships are real and tangible. Trust and awareness of being able to count on others are valuable aspects of a good life, especially during crises (Helliwell et al., 2021, 2014; Lindström & Giordano, 2016).[12] Although Siena was affected by COVID-19, it has a more resilient economy, efficient public services and a sounder safety net, aspects that have been proved to affect individual life satisfaction (Easterlin et al., 2012). These aspects could have mitigated the effects of lost income and reduced the ensuing sense of uncertainty (fear). As stated by Sarracino and Piekałkiewicz (2021, p. 1585) with respect to the 2007–08 economic crisis, "the buffering effect of social capital should, at least in part, compensate for the loss of well-being and ease the negative effects of the crisis".[13]

Contrary to expectations, income deterioration did not emerge as clear a predictor of decaying life satisfaction. This is quite consistent with Sarracino and Piekałkiewicz (2021)'s finding about the impact of the 2008 economic crisis. A prospective explanation may be that money is not important in itself but for the goods and services it permits us to buy and show off. The pandemic, and especially social lockdown, made spending money difficult, and therefore in some ways made it less desirable (Bimonte et al., 2022). Moreover, comparison was more difficult. It is now widely accepted that preferences are interdependent: life satisfaction also depends on how well an individual performs compared to others. It has been shown that if income growth is similar for all individuals in the same reference group, this does not make anyone much happier (Ferrer-i-Carbonell, 2005). The reverse situation could also be true.

[12] For a literature review see Lane (2017).

[13] On the relevance of values and cultural dimensions see also Moro-Egido et al. (2022). The latter presents useful references on this argument.

Table 7
Ordinal logit Regression results: model 7.

	Estimated coefficients	Odds ratios
Impact on income	0.03	1.03
(None/small = baseline)	(0.17)	(0.18)
Impact on social relations	0.97***	2.62***
(None/small = baseline)	(0.19)	(0.49)
Infected or knowing people with COVID-19	0.1	1.10
(None = baseline)	(0.12)	(0.13)
Area (*Siena* = *baseline*)		
Naples	0.19	1.21
	(0.22)	(0.27)
Other cities	−0.20	0.82
	(0.16)	(0.13)
Interaction effects		
Impact on income #Naples	0.83**	2.30**
	(0.39)	(0.89)
Impact on income #other	0.51*	1.66*
	(0.29)	(0.48)
Gender	0.59***	1.81***
(Male = baseline)	(0.13)	(0.23)
Age (continuous)	0.001	1.00
	(0.01)	(0.01)
Education	0.031	1.03
(No degree = baseline)	(0.12)	(0.13)
Single	0.43***	1.54***
(Not single = baseline)	(0.15)	(0.22)
Children	0.051	1.05
(No children = baseline)	(0.2)	(0.21)
Working condition (*work* = *baseline*)		
Student	0.16	1.17
	(0.18)	(0.21)
Out of labour force	0.69***	1.99***
	(0.22)	(0.44)
Observations	936	936

Our results also highlighted that likely the concerns related to COVID-19 infection did not influence life satisfaction. Although it had the expected sign, the relationship between satisfaction with life and the health threat, as reflected by self or relatives infected by COVID-19, was not significant. This seems at variance with empirical findings of a positive relationship between good health and reported life satisfaction (Ahmadiani et al., 2022).

Various studies have investigated the relationship between happiness and city size or rurality, without finding any clear relationship (Itaba, 2016): while some studies showed a positive effect of rural areas on subjective well-being (Shucksmith et al., 2009, Knight & Gunatilaka, n.d.; Davern & Chen, 2010), others found an inverse relationship (Best et al., 2000; Gilbert et al., 2016; Helliwell et al., 2018; Millward & Spinney, 2013) or no clear difference (Best et al., 2000; Mookherjee, 1992). Easterlin et al. (2011) maintain that the positive relation between rurality and happiness may depend on stage of development: it exists in less-developed countries, but is less clear in developed countries.

Although things could be different during a pandemic, our results did not show any overall relationship between city of residence and individual life satisfaction. As already mentioned, it only accounted for the loss of income effect. More than city of residence, what seemed to be important, especially during lockdown, was housing type: while no significant difference emerged between those living in the countryside and those dwelling in houses with garden in the city centre or suburbs, a significant difference exist with those living in a house without garden. The latter had a 1.4 (exp(0.35)) higher probability of experiencing a greater reduction in the level of life satisfaction. This is consistent with the study by Mouratidis and Yiannakou (2022) which found a positive link between urban built environment, proximity to parks, dwelling size and individual well-being in the COVID-19 period.

These findings did not change substantially when personal aspects were accounted for. Singles had a higher probability of experiencing a decline in life satisfaction. This aspect turned out to be significant in all the models that accounted for it. Isolation was presumably heavier for singles, especially during lock-downs. Although different, this result is consistent with and reinforce those reported in previous studies (Blanchflower & Oswald, 2004b; Frey & Stutzer, 2002; Helliwell, 2003; Qari, 2014).

A significant gender effect also emerged. Our results showed that females had a higher probability of experiencing a decline in life satisfaction: indeed they were 80 % more likely to do so than males. This is an interesting finding, in line with that of the Italian national statistical institute, which reported that women are less happy than men (Istat, 2019). One explanation is the double burden of many wives who work at home and outside (see Zoch et al., 2021). This was presumably truer during lockdowns, when most of the burden of housework, especially childcare, fell to wives.[14]

With regard to other personal aspects, in line with previous studies, age and education turned out not to be statistically significant (Ahmadiani et al., 2022; Helliwell, 2003). Although this result may depend on the characteristics of our sample, it is worth noting that research did not get any clearcut conclusion on these issues. In fact, while some empirical studies showed a positive effect of education on happiness (Cuñado & de Gracia, 2012; Di Tella et al., 2001; Stevenson & Wolfers, 2008), others have highlighted a non-significant (Inglehart & Klingemann, 2000) or even negative effect (Clark & Oswald, 1996; Ruiu & Ruiu, 2019).

5. Conclusions

Building on the "boiled frog" metaphor, our study aimed to analyse people's reaction to a dramatic unexpected change in their lives in terms of variation in life satisfaction. It also investigated which factors, among those most affected by the pandemic, best explained the perceived change in their wellbeing, and consequently which factors and policies may be useful "to jump out of the pot". Our heuristic hypothesis was that the pandemic and the policy response (lockdown) were a factual situation that allowed us to work in a "real world" rather than in a hypothetical framework, and permitted us to address the following questions: what happens to individual life satisfaction when people are forced into an exceptional, dramatic, economic, social and relational situation? Do relational goods still overshadow material possessions in predicting variations in individual life satisfaction? Is there any contextual or personal factor that may mediate this relationship?

The answers of the selected sample[15] suggest that life satisfaction was definitely threatened by the pandemic. According to participants' declarations, the pandemic also impinged on three important aspects of individual life: social relations, income and health, with slight differences between areas. Our outcomes suggest that only the first effect had a clearly significant and negative relationship with individual well-being. For the others, no relationship emerged with the COVID-19 infection variable, while the income effect was confined to Naples, where for the reasons explained above, its impact was presumably heavier or more acutely felt. In our opinion, this does not mean that income lost its importance as a determinant of happiness. It simply indicates that people prefer to invest in social rather material capital to cope with an unexpected and dramatic situation. Or, the other way round, the marginal utility of relational goods is higher than that of material goods: just as enhanced social capital is a road to happiness, its decay leads to unhappiness.

Relational goods, such as friendship, family relationships,

[14] Like for other aspects, the results are controversial. While some have shown that females are happier than males (Ahmadiani et al., 2022; Alesina et al., 2004; Inglehart, 2002), gender differences are normally not so large (Ferrer-I-Carbonell, 2013). However, our aim was to find relations between characteristics and changes in life satisfaction, not to compare the happiness of women and men.

[15] It is again worth underlining that since ours was a non-probability sample, no statistical inferences can be made.

neighbourhood connections and so on, are local public goods which are simultaneously consumed and produced (Gui & Sugden, 2005). Our results are in line with and somehow reinforce the findings of other studies (Becchetti et al., 2008; Gui & Stanca, 2010). Although they cannot be generalized, our results show that relational goods are also an important determinant of life satisfaction in times of pandemic crisis, in line with the findings of Sarracino and Piekałkiewicz (2021) in their research on the financial crisis. A prospective explanation is that the COVID-19 emergency forced people to comparatively re-evaluate goods and what they can "buy": while money buys material goods that are worthless during a pandemic, social relations "buys" moral support, i.e. an informal safety net that can provide support if needed. People become accustomed to slowly deteriorating social capital and do not realize that the ultimate currency they spend for better material conditions is emotional (Bimonte & Faralla, 2016): wealth and material goods compensate for draining relational goods (Bartolini & Bonatti, 2008). When unexpectedly threatened by a dramatic event (put into boiling water), people focus on and appraise what makes life worth living.

This analysis is also consistent with other aspects unveiled by our research: living in the countryside or in a house with a garden or yard, and being a male or married, reduced the probability of a decay of LS. The first two aspects are directly related to relational/community issues and the possibility of spending time out of doors, which could mitigate the impact of the pandemic on relational goods. This interpretation could also explain the gender effect. In comparative terms, women probably suffered the burden of COVID-19 more than men, and together with higher stress, this could have compromised their relation ties more than those of men.

Summing up, one can say that once again social relations turned out to be important for life satisfaction: those who most experienced a deterioration in social relations reported a greater decay in LS. Although the income effect had the right sign, it proved not to be statistically significant. The exceptional nature of the pandemic period not only made it clearer that investing in relational goods is a way to pursue satisfaction with life, it is also a way to face crises and hopefully "jump out of the boiling water". Investing in social relations and in policies that promote a cohesive community is rewarding; doing it during a crisis has an extra dividend. In a time of crisis, connectedness and trust are more appropriate than private and material goods in protecting our well-being.

5.1. Limitations and further research

Our results are intriguing and offer a new perspective for research on life satisfaction. This line of investigation is worth pursuing to understand the medium-to-long term effect, when the income effect will likely be reinforced, and to test our findings in a more representative sample. As stated in the introduction, the main shortcoming of our study was the sampling procedure constrained by time, budget, the difficulty of administering questionnaires and especially the impossibility of carrying out face-to-face interviews. The pandemic and the ensuing public policy responses were (hopefully) a non-reproducible experience that makes this kind of analysis difficult to replicate. Considering the abovementioned flaws and cautions, this study has to be taken as a natural experiment to test and discuss intriguing issues. Although the results are interesting and offer useful suggestions for public policies, as Corbin and Strauss (1990: 191) cautioned, they apply to a particular situation or circumstance but not to others. With this in mind, our findings are not perfect, but provide food for thought.

CRediT authorship contribution statement

Salvatore Bimonte: Conceptualization, Investigation, Writing – review & editing, Supervision. **Antonella D'Agostino:** Data curation, Methodology, Software, Visualization, Investigation.

Declaration of competing interest

We declare that the paper "Life satisfaction in the time of COVID-19: The frog effect", submitted by Salvatore Bimonte and Antonella D'Agostino, has not been published previously nor submitted for publication elsewhere.

Data availability

Data will be made available on request.

Appendix A

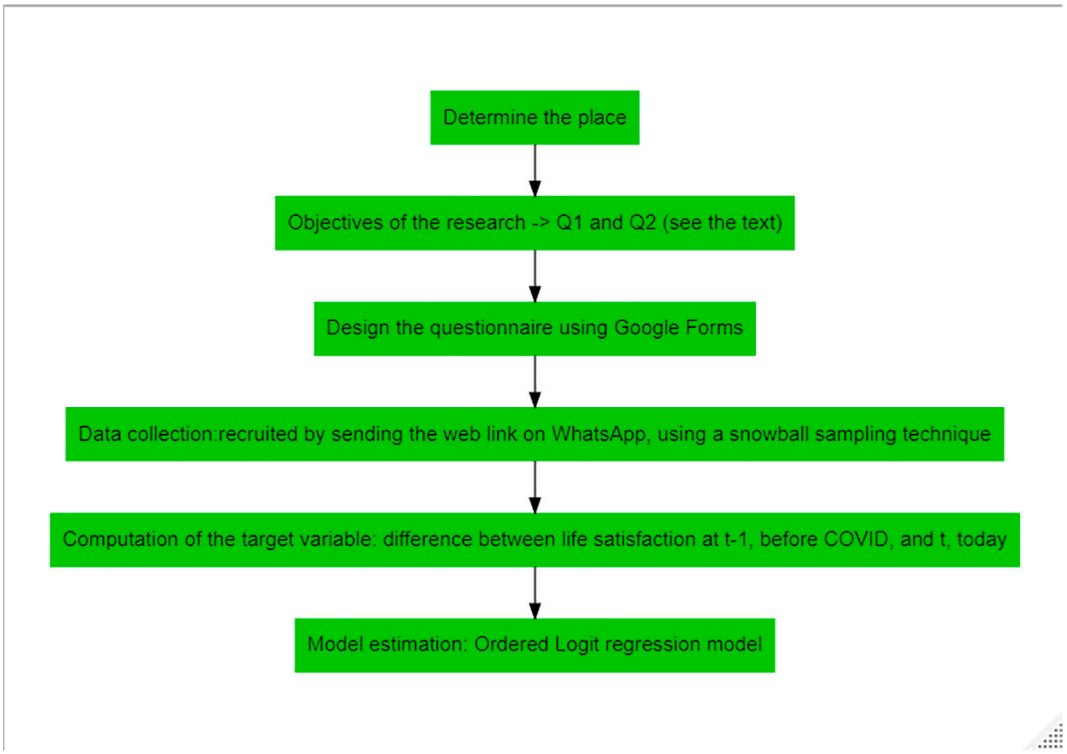

Fig. A1. Flow chart of methodology research.

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