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The effect of self-esteem on the spread of a pandemic. A cross-country analysis of the role played by self-esteem in the spread of the COVID-19 pandemic

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ABSTRACT

Extant research on COVID-19 suggests that many socio-economic determinants, by affecting personal behavior, have influenced the evolution of the pandemic. In this paper we study the role played in this regard by average levels of self-esteem in the public. There are reasons to believe that both low and very levels of self-esteem may have an effect on the spread of COVID-19, for opposite reasons. On the one hand, people with low self-esteem may not worry enough to behave in the way recommended (and prescribed, through non-pharmaceutical interventions) by the authorities; people with very high self-esteem, on the other hand, may be over-confident and fail to follow the prescriptions, believing that they do not need them. In this study we test this hypothesis by means of a quantitative cross-country analysis, using a hybrid model and the Rosenberg self-esteem scale. Our results suggest the existence of a U-shaped relationship between the trend of COVID-19 and average levels of self-esteem in a country.

1. Introduction

Self-esteem is a long-standing concept in the field of psychology (Rosenberg et al., 1995). Most of the extant research deals with the concept of *global* self-esteem, which is typically defined as one's overall sense of worthiness as a person (Baumeister et al., 1993; Branden, 1994; Rosenberg, 1979), or, in more technical language, as the individual's positive or negative attitude toward the self as a totality (Rosenberg et al., 1995).

Self-esteem is associated in the literature with various outcomes, which may be psychological, social and economic. As a consequence, given the vastness of the research on the subject, its definition is operationalized in different ways according to the specific domain it refers to. From the perspective of economics (and, more broadly, of the social sciences), self-esteem is typically considered as confidence in one's skills or abilities (Chatterjee et al., 2008; Drago, 2011; Kőszegi et al., 2022).

While the concept is of course a (very) complex one, and its definition may be given many shades and distinctions, it is also possible to simplify the framework by dichotomizing the determinant of these outcomes with two principal categories: high self-esteem and low self-esteem (Coopersmith, 1959). While high self-esteem is characterized by strong confidence and belief in oneself, and high satisfaction with oneself (Baumeister and Vohs, 2018), low self-esteem is on the contrary characterized by lack of confidence and the tendency to feel badly about oneself (Bajaj et al., 2016).

More specifically, several studies have found that low levels of self-esteem are associated with unhealthy behaviors. Ramiro et al. (2013) and more recently Bermudez et al. (2019) have shown that people with low self-esteem tend to engage in high-risk sexual behavior. People with low self-esteem have also been found to be more likely to experience mental health problems (Kim et al., 2018).

Nevertheless, negative behavioral outcomes are not always the result of low levels of self-esteem, but also the consequence of highly favorable self-appraisal, and characteristics such as arrogance, entitlement, extreme stubbornness, and overconfidence (Baumeister and Vohs, 2018). In particular, overconfidence involves the better-than-average effect, the illusion of control, and miscalibration of and unrealistic optimism regarding one's own judgments (Skala, 2008). It should be

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stressed that the ambiguous effects of high levels of self-esteem are not a novelty in the scientific research: previous studies had already noted the positive effects of high levels of self-esteem (egotism) on violence (Baumeister et al., 1996). More interestingly, high self-esteem is associated with superior self-regulation (Bandura, 1989; Heatherton and Ambady, 1993; Taylor, 1989), e.g., the capacity to adjust one's strivings to match a wide variety of circumstances. Nonetheless, Baumeister et al. (1993) provide useful insights into the link between individuals' highly favorable self-views and their decisions to commit themselves to unrealistic and excessively high goals, thereby increasing their likelihood of failure. Moreover, in empirical studies, the detrimental effects of high levels of self-esteem are also found in many important economics-related fields, including self-control (e.g., Shui and Ausubel, 2004) and health prevention(Oster et al., 2013). In particular, Oster et al. (2013) show how excessively optimistic beliefs about one's own health status can negatively affect the choice to take a (relatively) cheap pre-symptomatic test.

From this perspective, the threat represented by the unexpected and unpredictable nature of the COVID-19 outbreak – whose distressful psychological impact on people's everyday lives can partly be attributed to anti-COVID isolation policies (such as forced quarantine and stay-at-home measures), and partly to the threat itself (which, among other things, can cause infected people to be afraid of the social stigma and the avoidance of contact with other people, as suggested by Maunder, 2004 and Zheng, 2020) – has raised new and dramatic concerns about the effects of prevention behaviors on the effectiveness of health policies aimed at reducing contagion (Storopoli et al., 2020).

In particular, with specific respect to the link between average levels of self-esteem in the public and the trend of the COVID-19 epidemic in the country, while Rossi et al. (2020) show that self-esteem protects people from the impact of loneliness and fear on anxiety and depression, Lin and Chen (2021) investigate the role played by self-esteem characteristics (i.e., high versus low self-esteem) in the relationships between the risk perceived from COVID-19, the perception of the efficacy of the remedies designed to respond to the threat, and the fear provoked by the virus. In particular, the authors find in their study, which is based on a purpose-specific survey, that a lower perceived risk of COVID-19 infection was correlated with higher levels of self-esteem in the participants, as well as a lower rate of fear arousal. The study, therefore, suggests that higher self-esteem is related to a higher risk of getting infected by COVID-19 and hence of transmitting it. The authors suggest the design of specific healthcare interventions to target this group of people in the surge of a COVID-19 outbreak.

Interestingly, as noted in their study, and in line with the conclusions drawn by other works (see for instance Baumeister and Vohs, 2018 and Oster et al., 2013), people who report higher levels of self-esteem overestimate their competence and knowledge, thus limiting their ability to recognize the need for a behavioral change and reducing their commitment to compliant behavior.

Given the considerable effects on individuals' mental health and everyday life caused by the unpredictable nature of the COVID-19 outbreak and the unprecedented measures taken to fight it (Mukhtar, 2020), we believe that national anti-COVID rules that were imposed by various national governments during the COVID-19 pandemic, such as stay-at-home orders and lockdowns (Alfano et al., 2022a,b) – so-called non-pharmaceutical interventions (NPIs) – provide a very valuable case study with which to assess the importance of psychological traits, such as self-esteem, in the spread of contagion. Indeed, even if external commitments limit individuals' self-regulation by restricting the degree of choice in terms of goals available, the effectiveness of anti-COVID policies depends mostly on individual compliance with them, especially given the difficulty the police have in enforcing such policies over an entire population and territory (Alfano et al., 2022; Alfano and Ercolano, 2020).

In other words, while individuals' self-esteem does not have an important impact on the set of possible goals and commitments derived from a situational contingency, it can affect the individual decision to comply with national guidelines and rules issued to face it, as in the case of the COVID-19 pandemic, and therefore have an effect through self-regulation. This is if possible even more important given the psychological distress – provoked by isolation, social stigma, and social distancing – that has affected the everyday lives of people all over the world, and been raised still further by the unexpected nature of the threat represented by the COVID-19 outbreak.

Our research aim is thus to determine, taking a cross-country perspective, whether the average level of self-esteem in the public had any effect on the spread of COVID-19, through the impact it may have had on the levels of compliance shown by citizens toward the advice, rules, and regulations issued by governments during the pandemic.

We thereby aim to establish whether self-esteem is one of the many determinants to be taken into account by policymakers when designing a policy, or by public health specialists when predicting the spread of the contagion in a given region. Furthermore, we aim to assess whether the effect of self-esteem on individual compliance varies depending on its levels, with self-esteem positively associated with compliance attitudes up to a certain threshold, but then, at higher levels, possibly leading to opposite results, so that overconfident individuals become reluctant to comply with national anti-COVID prescriptions, and thus have a positive impact on the spread of the contagion.Our contribution differs from previous studies on this subject in a number of ways. First, while Lin and Chen (2021) focus on the role of self-esteem in the relationship between perceived threat and fear arousal related to COVID-19, in this paper we directly analyze the effect of self-esteem on aggregate behavior, and therefore on the spread of COVID-19 in terms of numbers of infections. Second, unlike previous studies, our analysis does not rely on a specific survey to collect information on self-esteem, as is typical in this literature; on the contrary, we use an international dataset already used in previous researches (Schmitt and Allik, 2005) that exploits the widely used Rosenberg Self-Esteem Scale (Rosenberg, 1965). As a result, our analysis is less likely to be affected by an *ad hoc* bias, which may easily affect empirical studies based on survey-gathered data. While possibly less precise in the estimation of their magnitude, results obtained in this way have greater general validity. Moreover, this empirical framework allows us to implement a cross-country approach: we were able to compare 53 different countries (the complete list of countries we were able to include in the analysis, given data constraints, is reported in Appendix A) on the basis of a specific measure for self-esteem (specifically, self-competence) with respect to those countries' daily data on COVID-19 infections during the first wave of the pandemic, i.e., between 1 January and August 31, 2020.

Our research, by means of a quantitative analysis using a hybrid model, shows that self-esteem has a negative, but marginally positive impact on the spread of COVID-19. This is consistent with the idea that the impact of average self-esteem on the evolution of the pandemic is non-linear: up to a certain threshold, an increase in self-esteem results in a lower level of spread of the contagion (possibly also thanks to a higher degree of compliance with the NPIs that have been imposed, and greater adherence to the advice given by public health experts); once the threshold is reached, high self-esteem becomes overconfidence, leading the pandemic to evolve in the opposite direction. Importantly, this mechanism, which we imagine explains our findings, is consistent with previous results (Baumeister et al., 1996; Lin and Chen, 2021; Oster et al., 2013).

The rest of this study is organized as follows: the next section discusses the link between self-esteem and compliance behaviors, and also provides a brief description of NPI policies. The third section describes data and the methodology used, while the section after that presents the results of our empirical investigation. Finally, the last section draws conclusions and indicates possible future lines of research.

2. Background

An important stream of research in the field of cognitive studies is devoted to understanding the relationship between the concept of self-esteem and compliance behaviors.

Although the concept of self-esteem has already been discussed above, with a brief description given of its principal classification, i.e., high and low levels of self-esteem, further elaboration is in order of the mechanism underlying the effect that we suppose self-esteem has on the choice to adopt a compliant attitude, especially in regards to health prevention behavior.

According to Crocker and Park (2003, 2004), the pursuit of self-esteem, e.g., the desire to protect, maintain, and enhance feelings of self-worth, is especially pervasive in Western societies. Indeed, in these societies the self and self-esteem are concepts that are strongly emphasized and valued. Following Park and Crocker (2013), improving self-esteem can thus reduce a variety of societal problems. Among other things, previous studies have highlighted academic underachievement, teenage pregnancy, crime, drug use, and alcohol abuse (Dawes, 1994; Mecca et al., 1989; Twenge, 2006). The way self-esteem can positively impact on social issues is due principally to its subsequent effect on self-regulation, a concept derived from the field of developmental psychology that describes a person's ability to generate socially approved behavior in the absence of external monitors (Maxwell, 1989).

A comprehensive review of the literature, however, reveals limited benefits from excessively high self-esteem, which calls into question the utility of the self-esteem movement and the validity of self-esteem as a construct more generally (Baumeister et al., 2003). In light of these findings, Baumeister et al. (1993) suggest that while, in the absence of an ego threat, subjects with high self-esteem show superior self-regulation, setting appropriate goals and performing effectively, an ego threat causes subjects with excessive levels of high self-esteem to set inappropriate, risky goals that are beyond their performance capabilities, ending up with smaller rewards than subjects with low self-esteem.

In other words, the increase in self-esteem can play a beneficial role, through self-regulation, for individuals when they set their own goals or standards and try to attain these goals and standards (Scheier and Carver, 1988). When in the presence of an ego threat, however, overestimating one's abilities, the consequence of overly high levels of self-esteem, may impede self-regulation in the attainment of goals and adherence to commitments (Heatherton and Ambady, 1993).

The aforementioned results regarding the role of self-esteem in self-regulation are very similar to those described in the related theoretical economic literature. In particular, as pointed out by Kőszegi et al. (2022), individuals may have unrealistically positive views of their traits or prospects, also driven by information-processing biases, which negatively affect the desired outcome in order to increase ego utility, anticipatory utility, or internal motivation (Bénabou and Tirole, 2003, 2016; Carrillo and Mariotti, 2000; Gervais and Odean, 2001; Grossman and Van Der Weelw, 2017; Kőszegi, 2006; Prelec and Bodner, 2003; Santos-Pinto and Sobel, 2005; Zábojnik, 2004).

Furthermore, along with the preceding works, a very interesting stream of research related to the concept of subjects' *defensiveness* provides further insights into the ambiguous role played by high levels of self-esteem in adopting particular behaviors with respect to health prevention in the event of a threat.

For example, Cohen (1959) posits a somewhat more complicated relationship, under conditions of threat or anxiety arousal, between self-esteem and persuasibility (that, for the sake of this research, which discusses compliance with government restrictions, we believe it is acceptable to treat the concepts of persuasion and compliance as substantially overlapping) which is the process involving human communication designed to influence the autonomous judgments and actions of others (Simons, 1976). Considering persuasion as either a threatening or a reassuring message, Simon presents experimental evidence that supports the idea that self-esteem is related to *defensiveness*. His assumption is that subjects with high self-esteem defend themselves against threats, but on the other hand respond favorably both to ego enhancement and reassurance. Contrarily, people characterized by low levels of self-esteem behave in the opposite manner (Lehmann, 1970).

This evidence is nevertheless in line with other empirical studies on the same subject (Nisbett and Gordon, 1967; Silverman, 1964a, 1964b). An established finding is that individuals characterized by high levels of self-esteem are more influenced by optimistic communications than by threatening communications. At the same time, people characterized by low levels of self-esteem show exactly the opposite pattern (on this point, see in particular Leventhal and Perloe, 1962).

Lehmann (1970) provides a more robust result regarding the evidence of the effects of self-esteem on subjects' persuasibility, also leading to a better understanding of the interaction between different levels of general anxiety and degrees of self-esteem. In particular, in his study on health communication in a department of obstetrics, Lehmann shows how, when trying to persuade women to return there for exams, low-anxious, low-self-esteem women were better motivated to do so by threat, while high-anxious, high-self-esteem women were better motivated by reassurance. These results thus provide strong evidence that the relationship between self-esteem and compliance attitudes is closely linked to the type and nature of the communication (threat/reassurance).

It should be recalled that the dramatic moments experienced during the unexpected first wave of the outbreak of the COIVD-19 pandemic pushed national governments to issue severe anti-contagion rules such as stay-at-home measures and lockdowns (Alfano et al., 2022a,b), and it seems legitimate to assume that these significantly affected the mental health of individuals due to the numerous important changes people were forced to make to their normal everyday routines. As a consequence, both quarantine and self-isolation measures, as well as the fear of contact with infection, contributed to heightening psychological stressors and ego threats in the public (Sheek-Hussein et al., 2021).

As regards the regulatory approaches aimed at imposing social distancing to contain the contagion, especially during the first wave of the pandemic, when a vaccine was not yet available, these were mostly NPIs. As already mentioned, these comprised policies whose effectiveness in preventing the negative effects of the pandemic (namely, the spread of the contagion) has been largely proven by a number of studies, and included stay-at-home orders and lockdowns (Alfano and Ercolano, 2020; Khairulbahri, 2021; Kumar et al., 2021; Tallon et al., 2020) and school closures (Alfano, 2021a, 2022b; Alfano et al., 2021). These unprecedented measures were of great importance all over the world (unprecedented, at least, in recent decades, since the adoption of such remedies can in fact be traced back to the Middle Ages; see Alfano and Sgobbi, 2022), and the number of national laws and local regulations aimed at regulating aspects of social life and reducing the probability of contagion boomed in the first half of 2020. As said, however, the weakness of these public policies derives mostly from the effective role played by individuals' compliance with national rules.

While still novel, an already rich literature has studied and is studying the efficacy of NPIs (Alfano, 2021b, 2022b; Alfano and Ercolano, 2020; Alfano et al., 2021; Ejigu et al., 2021; Kantor and Kantor, 2020; Soltesz et al., 2020) and its determinants (Alfano, 2021a, 2022a; Gauvin et al., 2021; Maloney and Taskin, 2020; Seale et al., 2020; Xu et al., 2020). Surprisingly, this second branch of the literature still has only a small number of studies looking specifically at the effect of self-esteem on the COVID-19 pandemic.

3. Research hypotheses, empirical strategy and data

On the basis of the mechanism assumed in the introduction and discussed in more depth in the previous section, our analysis aims to determine, from a cross-country perspective, whether the average level of self-esteem in a population has any effect on the spread of COVID-19. In more specific terms, and within the context of a threat as serious as

that posed by the COVID-19 outbreak, people with low self-esteem may not worry enough to behave in the way recommended (and prescribed, through NPIs) by the authorities in order to avoid contagion. At the same time, people with very high self-esteem may be over-confident and fail to follow the prescriptions, believing that they do not need them. Accordingly, our research question may be subdivided into the following research hypotheses.

i. An increase in the levels of self-esteem negatively affects the number of new COVID-19 infections, effectively contributing to the reduction of the spread of the contagion, *ceteris paribus* for stringency measures, up to a certain threshold, and with diminishing marginal increase;
ii. Over this threshold, an increase in the level of (already high) self-esteem leads to the opposite result; therefore an increase in self-esteem over this threshold will result in a positive impact on the spread of the contagion, *ceteris paribus* for stringency measures imposed.

We aim to answer the research question by assessing the validity of both the aforementioned hypotheses by means of a quantitative analysis, performed with regression analysis on a panel dataset assembled from public data for this specific purpose.

In this setting, a major challenge in the empirical strategy is to avoid the several time-invariant variables that differ in each of the countries included in the analysis – such as population density, median age of the population, or quality of the healthcare system – which may play a role in this relationship and create a bias that affects the results. A common strategy to avoid such a problem in this kind of analysis is to perform a fixed effects estimation, which nonetheless as a consequence makes it impossible to estimate the impact of time-invariant variables on the dependent variable. This is the way self-esteem is usually operationalized in such a setting, since of course the national self-esteem average is not a piece of data that is available on a day-by-day basis (and even if available its usefulness in this case would be questionable). A solution commonly offered in such cases by the literature is to estimate within-effects in random-effects models (Allison, 2009; Neuhaus and Kalbfleisch, 1998; Rabe-Hesketh and Skrondal, 2008; Raudenbush, 1989; Wooldridge, 2010). As already suggested by Schunck (2013), this empirical strategy allows the effects of time-invariant variables to vary between clusters, which makes it possible to estimate them, thanks to the inclusion of random slopes. This approach has already been used in this kind of estimation, with specific reference to research devoted to estimating the determinants of the spread of COVID-19 (Alfano, 2021b, 2022a).

Accordingly, we will assess the impact of self-esteem on the spread of COVID-19 by estimating the following equation:

$$\Delta i_{ct} = \alpha + \beta_1 (i_{ct-1} - \overline{i_c}) + \beta_2\, \overline{i_c} + \beta_3 (Str_{ct-28} - \overline{Str_c}) + \beta_4 \overline{Str_c} + \beta_5 SE_c + \beta_6 SE_c^2 + \beta_7 PopDens_c + \beta_8 MedAge_c + \beta_9 GDPpc_c + \mathrm{T} + \varepsilon \quad (1)$$

where.

- Δi, our dependent variable, represents new COVID-19 cases in country *c* at time *t*, with respect to *t-1*;
- i_{t-1} is the total number of infections registered in country *c* on *t-1*. As usual in hybrid models, this variable is decomposed into its *within* country part (i.e., the difference from the country mean of each observation $i_{ct-1} - \overline{i_c}$) and its *between* country (i.e., each country's mean, $\overline{i_c}$);
- *Str* is the level of stringency of the different NPIs in place, for each country *c* on each day *t*. These values are lagged by twenty-eight days, following the literature on the subject (Alfano, 2021b, 2022a), so that the different NPIs actually have an effect on the reporting of new COVID-19 cases (as will be explained in more detail below). This variable, as in the previous case, is decomposed into its within country part and between country part;
- *SE* is a time-invariant variable that proxies the self-esteem needed to test our hypotheses, and its square to check for non-linear effects;
- *PopDens* is the population per square kilometer (data from the World Bank referred to 2018, the last year for which data are available). Population density, as suggested in the literature, is likely to have an effect on the spread of COVID-19 cases (Alfano et al., 2021);
- *MedAge* is the population's median age (data from United Nations, referred to 2020), which is another important demographic difference between countries that has been suggested as possibly playing a role in the spread of the contagion, both because of the different behavior of populations of different ages, and because of its effects on the spread of contagion (Alfano, 2021b);
- *GDPpc* is the Gross Domestic Product per capita expressed in purchase power parity, with constant international dollars from 2017 (data from the World Bank referred to 2019), in order to capture socio-economic differences in the population which, as suggested by previous contributions, are likely to have an effect (Ashraf, 2020; Alfano, 2021b). Data are referred to 2019, and thus before the pandemic, in order to avoid any "look behind" effect;
- *T*, a matrix of time fixed effect, is included in the equation to take into account the elapsing of time and its impact on the evolution of the pandemic;
- ε, as usual, is the error term.

The main objective of this empirical strategy is to estimate, respectively in β_5 and in β_6, the linear and quadratic impact of self-esteem on new COVID-19 cases. To empirically estimate equation (1), we gathered data from a number of sources. For daily data on COVID-19 (both in the initial difference between *t* and *t-1*, used to operationalize our dependent variable *New Cases pm*, and in the absolute value on *t-1*, used to operationalize *YCases pm*), we rely on Hale et al., (2020a) (data gathered from https://github.com/OxCGRT/covid-policy-tracker/blob/master/data/timeseries/OxCGRT_timeseries_all.xlsx; for both the variables we divided the cases reported by the population, data taken from the World Bank dataset, and multiplied the result by one million, in order to have a *per million inhabitants* value, and coefficients that are easier to be read). The same goes for stringency measures, which operationalize *Str* through the *Stringency Index*, an index offered by Hale et al. (2020a) (data available at https://github.com/OxCGRT/covid-policy-tracker/blob/master/data/timeseries/OxCGRT_timeseries_all.xlsx), which is the sum of several sub-indexes that is then rescaled on a 0–100 scale. This is compiled by numerous scholars from a vast range of sources, and has been available worldwide with data on a daily basis since January 1, 2020. For further details we refer the reader to Hale et al. (2020a and b). This is a widely used source in this branch of the literature (Alfano, 2021b, 2022a; Alfano and Ercolano, 2020).

Meanwhile, there is the operationalization of average levels of self-esteem. For this we chose to rely on the well-known Rosenberg Self Esteem Scale (RSES) (Rosenberg, 1965). The measurement of self-esteem is a pivotal issue in psychology, and dates back to James's (1890) seminal writings on the self (Robins et al., 2001). Over the years researchers have proposed a number of different self-esteem measures (e.g., Block and Robins, 1993; Demo, 1985; Greenwald et al., 1998; Kitayama and Karasawa, 1997; Savin-Williams and Jaquish, 1981;

Waters et al., 1985). However, as clarified by Robins et al. (2001), the vast majority of researchers rely on face-valid self-report scales. Of these, the RSES is by far the most widely used (Blascovich et al., 1991; Gray-Little et al., 1997). There are several reasons for the popularity of the RSES. This is naturally due to its long history of use, but, as highlighted by Schmitt and Allik (2005), its advantages also include the use of uncomplicated language, and its brevity. Indeed, it only takes a few minutes to be completed (Schmitt and Allik, 2005). The (relative) simplicity of the RSES and its accessibility have also favored a considerable number of translations into different languages. Translations include basically all Indo-European languages, and also languages such as Chinese, Japanese, Persian and Estonian (Schmitt and Allik, 2005). It is therefore an optimal choice in a cross-country framework. This does not mean that the RSES has not been criticized. It is important to warn the reader that a generalized scale, such as the RSES, has substantial limitations. Among these the literature has identified its scope and the number of items it includes, the logical progression of difficulty among the items, its unidimensionality, negative statements included in the rating scale, and the contextual relevance of items underlying the self-esteem construct (Classen et al., 2007). Moreover, while psychometric studies have generally supported the unidimensionality of this scale (Mullen et al., 2013), a stable response-bias has been associated with the wording of the items (Marsh et al., 2010).

Since the 1980s the study of specific aspects of global self-esteem have also gained increasing importance in the relevant body of research (e.g., Harter, 1985; Marsh and Shavelson, 1985; Swann, 1987). Some studies in this vein have found underlying sub-factors within the RSES (Carmines and Zeller, 1979; Tafarodi and Swann, 1996). Among these, Schmitt and Allik (2005) explore whether cultures systematically differ in the self-competence and self-liking facets of global self-esteem (Tafarodi and Milne, 2002; Tafarodi and Swann, 2001); in their words, self-competence is the instrumental feature of the self as causal agent, the sense that one is confident, capable, and efficacious, while self-liking is the intrinsic feature of the self as a social object, the sense that one is seen as a good person, is socially relevant, and contributes to group harmony (*ibid.*, p. 625). Given its individualistic dimension, self-competence specifically measures one's ability to cope with stress (Bandura, 1977, 1982; Seligman, 1975). Because we aim to understand the role played by high levels of self-esteem in the spread of the pandemic, in the context of tightening national regulations during a period of crisis, we chose to analyze how and to what extent self-competence – i.e., the confidence one should feel about self-regulation and self-managing when responding to various (stressful) situations – affected number of infections and contagions. As a consequence, in our data self-esteem is operationalized through the country average of self-competence, as presented in Schmitt and Allik (2005, p. 636).

All these operations result in the construction of a panel dataset composed of 53 countries observed for 244 days (from 1 January to August 31, 2020, e.g., the first COVID-19 wave). 28 observations for each country were lost because of our decision to lag stringency by 28 days, in accordance with previous studies (Alfano, 2021b, 2022a). This is necessary because of the need to allow some time to elapse before observing the effect of NPIs on the new contagions, to avoid imputing a shift in the trend to a NPI that could not have had any effect yet (and to avoid biases due to the so-called weekend-effect, Soukhovolsky et al., 2021). This resulted in a final dataset composed of 53 (countries) observed for 216 days, giving a total of 11,448 observations. Please note that there are no missing data in the panel, and therefore there is no need to use any sort of imputation strategy, which may hinder or bias the results (Sidi and Harel, 2018). Also, the statistical power of the analysis seems to be appropriate. A power analysis for an R-squared test in a multiple linear regression, estimating the needed sample size for our most inclusive regression, suggests that in our case the sample composition should be of 90 observations, or 178 in the most inclusive specification. In our dataset we have a total of 11,448 observations, and the statistical power should therefore be more than sufficient even for the detection of small statistical significances.

Descriptive statistics about the variables are presented in Table 1, while Fig. 1 graphically presents in a heat map the levels of the main variables for the countries included in the analysis.

4. Results and robustness

Estimation results of equation (1) obtained with STATA (the code used is attached in supplementary files) are presented in Table 2. To avoid biases due to omitted variables, and to observe an eventual change in the statistical significance and the coefficient once the other determinants are included in the equation, following Alfano (2021b), demographic characteristics (*PopDens* and *MedAge*), and the proxy of socio-economic levels (*GDPpc*) are included one at a time in the estimation subsequently (columns 2.2 and 2.3). As can be seen, *YCases pm* is

Table 1
Descriptive statistics.

Label	Variable	Mean	Sample	Std. dev.	Min	Max	Observations	Source
NewCases pm	New daily COVID-19 cases in the country	19.17696	overall	43.25499	−255.0705	756.6371	N = 11,448	Authors elaboration from OxCGRT COVID Policy Tracker dataset.
			between	24.50938	.0406,252	100.577	n = 53	
			within	35.79898	−256.9047	754.803	T = 216	
YCases pm	Total COVID-19 cases on the day before in the country	1358.161	overall	2640.975	0	21632.19	N = 11,448	Authors elaboration from OxCGRT COVID Policy Tracker dataset.
			between	1604.461	5.318225	7296.82	n = 53	
			within	2109.22	−5938.659	15811.08	T = 216	
Str	Oxford Stringency index lagged by 28 days	53.91648	overall	28.06552	0	100	N = 11,448	OxCGRT COVID Policy Tracker dataset.
			between	10.03591	26.73745	73.87625	n = 53	
			within	26.24587	−18.52403	104.9114	T = 216	
PopDens	Population per square kilometer in 2017	334.1414	overall	989.9306	3.29767	7149.905	N = 11,448	World Bank Databank - Population density.
			between	999.3602	3.29767	7149.905	n = 53	
			within	2.20e-12	334.1414	334.1414	T = 216	
MedAge	Country median age in 2020	36.73338	overall	8.495741	16.988	48.358	N = 11,448	United Nations' Databank – Median age.
			between	8.576667	16.988	48.358	n = 53	
			within	9.27e-14	36.73338	36.73338	T = 216	
GDPpc	Gross Domestic Product per capita expressed in PPP international 2017 dollars	31318.66	overall	17737.65	1097.949	70944.35	N = 11,448	World Bank Databank – GDP per capita PPP (2017 $).
			between	17906.61	1097.949	70944.35	n = 53	
			within	1.13e-10	31318.66	31318.66	T = 216	
SE	Average Self-Competence from Schmitt and Allik (2005).	16.24453	overall	.8,602,253	13.33	17.76	N = 11,448	Schmitt and Allik (2005, p. 636).
			between	.8,684,194	13.33	17.76	n = 53	
			within	0	16.24453	16.24453	T = 216	
SE sqr	Square of Self-Compete from Schmitt and Allik (2005).	264.6246	overall	27.30573	177.6889	315.4176	N = 11,448	Authors' elaboration from Schmitt and Allik (2005, p. 636).
			between	27.56583	177.6889	315.4176	n = 53	
			within	0	264.6246	264.6246	T = 216	

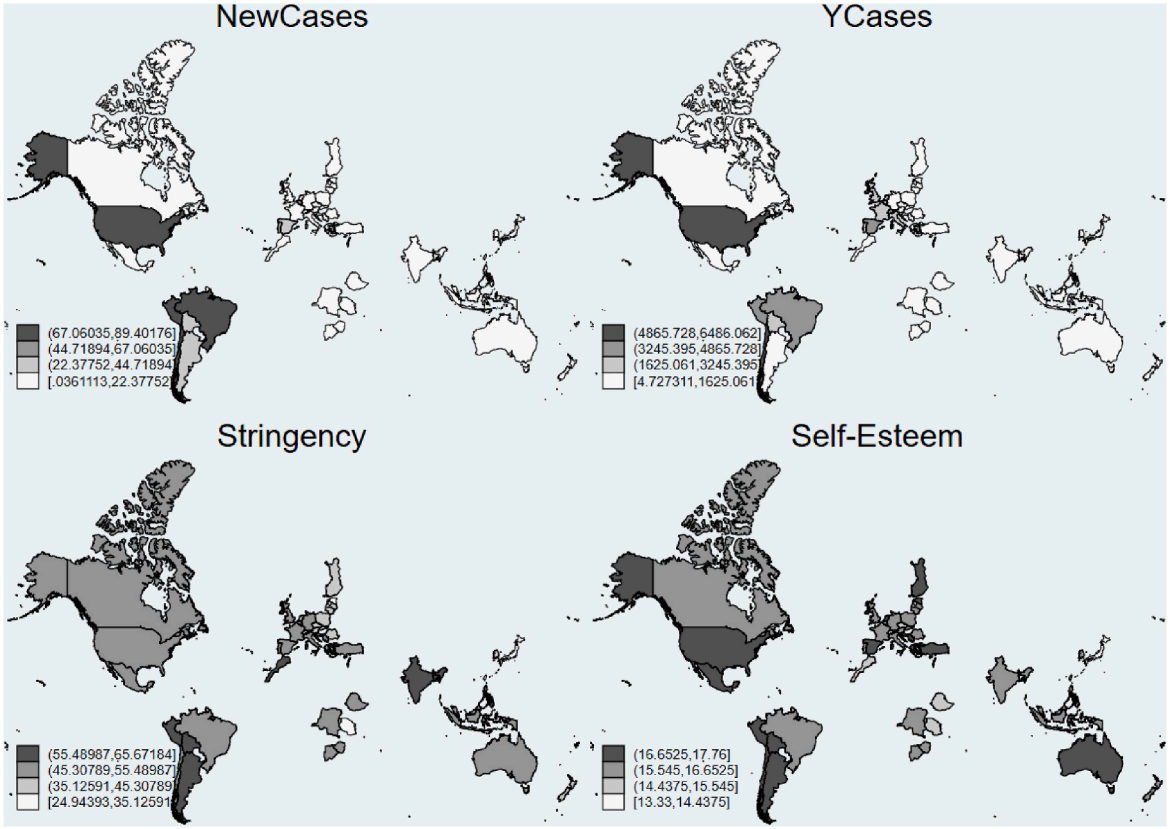

Fig. 1. Heat map of the main variables.

Table 2
F-GLS hybrid model.

	(2.1)	(2.2)	(2.3)
	New Cases pm	New Cases pm	New Cases pm
YCases pm_within	0.00879***	0.00878***	0.00878***
	(5.62)	(5.62)	(5.62)
YCases pm_between	0.0134***	0.0142***	0.0148***
	(12.49)	(13.18)	(12.48)
L28.Str_within	0.0436	0.0438	0.0439
	(0.63)	(0.63)	(0.63)
L28.Str_between	0.422***	0.225	0.152
	(3.32)	(1.57)	(1.03)
SE	−56.83**	−53.15*	−49.03*
	(-2.09)	(-1.95)	(-1.89)
SE Sqr.	1.849**	1.738**	1.609*
	(2.09)	(1.98)	(1.91)
PopDens		0.000627	0.00130**
		(1.08)	(2.20)
MedAge		−0.364***	−0.0659
		(-2.87)	(-0.35)
GDPpc			−0.000217**
			(-2.08)
Time Fixed Effects	YES	YES	YES
Constant	410.2**	401.4*	367.0*
	(1.97)	(1.90)	(1.83)
Observations	11,448	11,448	11,448
Overall R2	0.489	0.493	0.495

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

positive and statistically significant in all the specifications. This suggests the exponential nature of the pandemic, and confirms that the more COVID-19 cases there were yesterday, the more newer cases there will be today. The statistical non-significance of the operationalization of the stringency measures suggests that in this sample (and therefore in a cross-country, cross-seasonal framework), NPIs had no statistically significant generalized impact during the first wave, at least after 28 days, on the *New Cases pm*, when all the other variables in place are considered. Of course, given the data-driven nature of the sample, this is not significant in terms of external validity, and therefore in terms of the overall effectiveness of NPIs. As expected, in our most complete specification (2.3), *PopDens* has a positive impact on the trend of COVID-19 cases, while *MedAge* plays no statistically significant role in this relationship, a result that confirms what has already been found by Alfano (2021b). Moreover, once we have controlled for NPIs, richer countries have fewer COVID-19 cases on average during the first wave than countries with a lower *GDPpc*.

Moving on to the variable of greatest interest for this study, the negative coefficient of *SE* suggests that the higher the average level of self-esteem is in a country, the fewer COVID-19 cases there will be, *ceteris paribus* for the evolution of the pandemic (controlled via *Ycases pm*), and the daily national stringency level due to the NPIs in place (*Str*). This suggests the positive role played by self-esteem in the containment of the pandemic. At the same time, when checking for possible non-linear effects through the quadratic term, we see a positive and statistically significant term, revealing the existence of a U-shaped relationship between self-esteem and the evolution of COVID-19 cases, *ceteris paribus* for NPIs in place. In other words, the higher the level of self-esteem, the lower the trend of cases will be, up to a given threshold, where an increase of self-esteem corresponds to an increase in the number of COVID-19 cases. This turning point is of course equal to $-\frac{\beta_5}{2\beta_6}$, or to an average score on the self-esteem scale of 15.23, according to the estimate of model (2.3). In other words, from a value of 10 up to a value of 15 on the self-esteem scale, an increase of one point of self-esteem leads on average to about 20 fewer COVID-19 cases per million inhabitants each day. Of course, a much greater decrease is predicted from countries below the threshold of 10 points on the RSES scale, given the steepness of the curve. This value, as shown in Fig. 2 and described in the tables, decreases with the increase of average self-esteem, up to having a

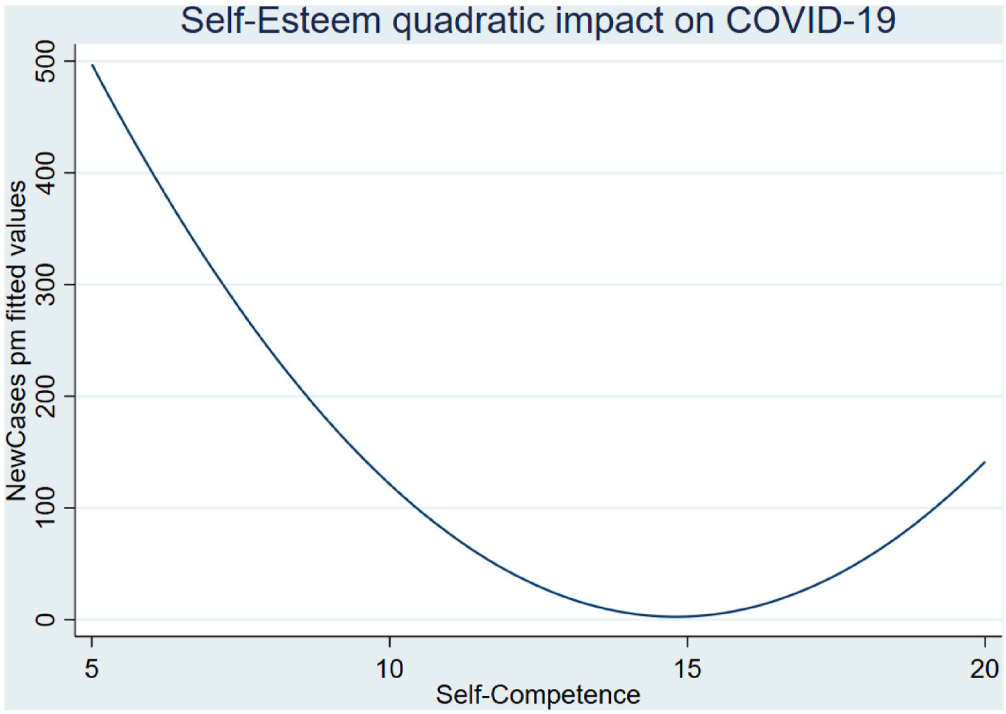

Fig. 2. Self-Esteem impact on the trend of COVID-19 cases.
Source: Authors' elaboration.

different overall effect with a change in the sign. In other words, once the turning point in Fig. 2 is reached, a further increase in self-esteem leads to an increase in COVID-19 cases.

It is important to highlight that this estimate, which can be interpreted as being the average value of what happened in 53 different countries in quite different contexts and seasons, is on the one hand a point estimate with low precision and a huge standard error. It is accordingly a value that is not really applicable to different cases and samples, and as a consequence an estimate that has to be taken with caution. At the same time, it is also important to note that the theoretical point about the U-shaped relationship between self-esteem and COVID-19 diffusion is confirmed by an estimation obtained in a sample composed of a variety of countries, and thus presents an interesting degree of robustness. The statistical significance of the coefficients suggests that it is a factor to be taken into consideration by policymakers and public health specialists when designing optimal policies to slow down and fight epidemics. While using such a regression analysis to infer a direct, causal effect of overconfidence on the trend of COVID-19, especially in an empirical framework such as ours, is always a tricky and dangerous exercise, we believe that this analysis presents an interesting set of results. Furthermore, given that data on overconfidence are observed much earlier than those on COVID-19, it should be highlighted that our exercise cannot be affected by a reverse causality issue.

Nevertheless, the reader should be warned that it is especially hard to assess the presence of a causal link with an analysis based on aggregated and observational data. That being said, it is also noteworthy that the lagged structure of the estimated equation is useful for interpreting the results in terms of a (possible) direct effect, rather than simply in terms of a robust (*ceteris paribus*) correlation, which we believe would nonetheless be an interesting finding suitable for use as preliminary evidence in future studies.

Finally, it is important to underline that another possible shortcoming of this analysis is due to the fact that the daily number of new COVID-19 cases is an extremely noisy variable if compared to the operationalization of self-esteem. In such cases, the literature suggests removing the cyclical component from the time series for each country

Table 3
F-GLS Hybrid Model – Hamilton Filter robustness.

	(3.1)	(3.2)	(3.3)
	NewCases pm-Hamilton Filter	NewCases pm-Hamilton Filter	NewCases pm-Hamilton Filter
YCases pm_within	0.00748***	0.00748***	0.00748***
	(4.43)	(4.43)	(4.43)
YCases pm_between	0.0139***	0.0146***	0.0153***
	(12.98)	(13.92)	(13.21)
L28.Str_within	0.126***	0.126***	0.126***
	(3.28)	(3.28)	(3.28)
L28. Str_between	0.441***	0.234	0.159
	(3.35)	(1.57)	(1.04)
SE	−59.60**	−55.71**	−51.43*
	(-2.11)	(-1.97)	(-1.92)
SE Sqr.	1.938**	1.821**	1.687*
	(2.12)	(2.01)	(1.94)
PopDens		0.000662	0.00136**
		(1.10)	(2.22)
MedAge		−0.381***	−0.0715
		(-2.91)	(-0.37)
GDPpc			−0.000226**
			(-2.09)
Time Fixed Effects	YES	YES	YES
Constant	443.1**	433.6**	397.8*
	(2.05)	(1.99)	(1.92)
Observations	11,024	11,024	11,024
Overall R2	0.670	0.676	0.680

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

(Hodrick and Prescott, 1997). This solution has already been applied in research on COVID-19 (Alfano et al., 2022a,b). Recently, Hamilton (2018) criticized the removal of excess variability through a Hodrick-Prescott filter (note that regressions using as a dependent variable the New Cases pm treated with the HP filter present equivalent results, not included in order to save space but available from the corresponding author upon reasonable request), arguing that it introduces spurious dynamic relations that have no basis in the underlying

data-generating process. We therefore replicated the analysis using the procedure suggested by Hamilton (2018). The results, presented in Table 3, are consistent with our main estimates. We may thus conclude that excess variability does not significantly affect our findings.

5. Conclusions

While the role played by self-esteem in social outcomes has been studied for decades, surprisingly the potential negative effect of high levels of self-esteem within a country has remained a less explored topic. Nonetheless, the spread of the COVID pandemic, and the subsequent implementation of NPIs and lockdowns, has raised serious psychological concerns in the public, thus giving individual psychological traits a more important role, even in a public health context, when it comes to explaining the individual choice of whether or not to comply with anti-COVID regulations.

To summarize our contribution, the present study has found a correlation between international differences in self-esteem among countries and the spread of COVID-19, taking into account the main variables that play a role in this relationship. Potentially, this mechanism has an impact through the public's varying compliance with the NPI policies that are enforced, thus altering their effectiveness. Furthermore, and possibly more importantly, our framework has allowed us to explore the relationship between high levels of self-esteem, or "egotism", as defined by Baumister et al. (1993 and 1996), and the effect this has had on the spread of the pandemic.

In particular, our results suggest that while an increase in self-esteem played a positive role in containing COVID-19 contagion when the variable was set to a low level, we found empirical evidence of a change in this relationship when higher levels of self-esteem were observed. This finding confirms previous results regarding the negative effects of high levels of self-esteem on social outcomes, and, more specifically, on the capacity for behavioral change and the adoption of a more compliant attitude.

Finally, our results also provide useful insights for a rethinking of national policies aimed at containing airborne contagions: we explicitly suggest, in line with previous studies (Lin and Chen, 2021), that public communication should be tailored for people with a lower perceived risk of infection and lower fear arousal; in other words, people with the highest levels of self-esteem. As a matter of fact, these results are in line with the goals of various communication campaigns, which are targeted at different strata of society, characterised by different levels of self-esteem, to increase the efficacy of NPIs and fight the spread of the virus more effectively.

While interesting insofar as it provides the first evidence – to the best of our knowledge – of an impact of self-esteem on the aggregate evolution of COVID-19 within each country, our analysis has some limitations that the reader should be warned about. First, the sample on which we performed our analysis is not the result of a sampling operation, but was the result of data constraint. While there are no specific reasons to believe that our sample is affected by a specific selection bias – on the contrary, our sample is drawn from very diverse countries – it is possible that the set of countries included in the analysis are not representative of some parts of the global population. We therefore invite the reader to interpret our results with caution, especially with regard to the extension of the present findings to different specific cases. Second, the numbers of COVID-19 cases reported by several governments, as used in the dataset we used for our analysis (Hale et al., 2020a), may not correspond to the real number of COVID-19 cases, due to well-known problems with testing policies and their heterogeneity during the first wave. While we recognize this limit to the operationalization of the spread of COVID-19, we believe that it remains the best available option, since the number of deaths is affected by similar biases, and the number of excess deaths suffers from a lag problem (i.e., it is hard to determine when someone who died because of COVID-19 got infected, which is the event related to personal behavior and possibly to a lack of compliance with governmental advice and regulations). Finally, the use of the RSES to proxy average levels of overconfidence in countries around the world is a simplification that may include some biases. While we believe that it is the best option on the table given its availability and suitability for use in a cross-country framework, it is important to warn the reader that such a generalized scale has substantive limitations.

In conclusion, given the importance of the subject and the need to fix the above empirical issues, further research is suggested. Future studies may focus on different samples, trying to extend or falsify our findings in different contexts, or focus on different psychological dimensions that may have an impact on this relationship through personal behaviour.

Credit author statement

Vincenzo Alfano: Conceptualization, Methodolgy, Data curation, Writing – original draft Massimo Guarino: Conceptualization, Validation, Writing – original draft, Writing – review & editing.

Data availability

Data will be made available on request.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2023.115866.

Appendix A. List of countries included in the analysis

Argentina, Australia, Austria, Bangladesh, Belgium, Bolivia, Botswana, Brazil, Canada, Chile, Croatia, Cyprus, Czech Republic, Democratic Republic of Congo, Estonia, Ethiopia, Fiji, Finland, France, Germany, Greece, Hong Kong SAR, India, Indonesia, Israel, Italy, Japan, Latvia, Lebanon, Lithuania, Malaysia, Malta, Mexico, Morocco, Netherlands, New Zealand, Peru, Philippines, Poland, Portugal, Republic of Korea, Romania, Serbia, Slovak Republic, Slovenia, Spain, Switzerland, Taiwan, Tanzania, Turkey, United Kingdom, United States of America, Zimbabwe.

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