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First published 2020

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Acknowledgements

Partial support from the National Natural Science Foundation of China (71774091 for CC and 71810107004 for LL) and from Tsinghua Research Program (2017THZWLJ02 for LL) is acknowledged. We also thank Dr. Xia Li for his helpful suggestions and valuable comments on our research.

Do National Cultures Matter in the Containment of COVID-19?

Introduction

In December 2019, an unusual pneumonia-like illness erupted in Wuhan, the capital city of Hubei province in central China. A novel strain of coronavirus, or SARS-CoV-2, a member of the coronavirus family, turned out to be the culprit infecting Chinese people across the country and then rapidly sweeping the world. The World Health Organization (WHO) declared the outbreak a "Public Health Emergency of International Concern" on January 30, 2020 and a "pandemic" on March 11. As of August 22, 2020, there were 22,812,491 confirmed cases of the coronavirus disease, COVID-19, including 795,132 deaths, resulting in devastating social, economic, and political consequences (WHO, 2020).

To mitigate or even stop the viral transmission, and indeed, a global public health crisis that stands unprecedented in living memory, governments worldwide have imposed various interventions, some as severe as locking down an entire city or a larger part of a country, closing borders, and restricting travel within borders; others as moderate as tracing and quarantining those exposed to the virus, maintaining social-distancing, enacting shelter-in-place or stay-at-home, and paying attention to personal hygiene. Implementation of such measures requires not only governments' strong resolve but also the public's voluntary and simultaneous compliance and self-disciplining out of everyone's interests.

Months into the world's fight against the coronavirus, there are growing signs that the outbreak is ebbing in some quarters of the world. This affords us an opportunity to evaluate the effectiveness of national mitigation strategies. Indeed, the effective performance is enveloped in and influenced by a nation's level of socio-economic development. For example, available

healthcare resources such as hospital beds, intensive care units, ventilators, and testing capacity affected the containment efforts (Li *et al*., 2020); elderly people were more vulnerable as seen in elevated numbers of serious illness and death (United Nations, 2020); low-income communities and people of color were being hit the hardest not only because of their higher levels of preexisting health conditions and lower access to healthcare but also because they were less able to afford to practice social distancing in the United States (van Dorn *et al*., 2020; Weill *et al*., 2020) while income deprivation and ethnicity were associated with greater COVID-19 mortality in England (Rose *et al*., 2020). Other factors, such as humidity and temperature, national research capacity and expertise, magnitude and timing of interventions, and strategic planning for emergencies, matter as well.

However, there also needs to be a cultural understanding of the relationship between restrictive measures and containment efforts as culture may be pivotal to satisfactory outcomes. Human behavior is culturally based and embedded and citizens in different countries may respond to the same challenge differently. Ultimately, lifesaving and suffering-relieving could only be achieved through behavioral change of the affected citizens. Bearing this in mind, this article presents an effort to explore whether national cultures affected the viral containment by way of behavioral changes.

Inspired by the studies of national cultural dimensions (Hofstede, 1980; 1983; 2001) and of cultural tightness–looseness (Gelfand, 2018; Gelfand *et al*., 2006; Gelfand *et al*., 2011), we developed an integrated framework of individualism–collectivism and tightness–looseness to investigate how differences in national cultures may have affected the outcomes of the COVID-19 containment. We traced the effectiveness of a nation's lockdown or similar measures (hereafter referred to as "lockdown") during a 30-day period after its 15-day implementation

using three popular public health indicators: the change of prevalence rate (ΔPR), the change of crude mortality rate (ΔCMR), and the case fatality rate (CFR).

In what follows, we review relevant literature and develop our theoretical framework. Then we use country-level data to empirically test how cultures shaped nations' responses to the pandemic and how countries with variations in cultural tightness–looseness and individualism–collectivism led to different outcomes in containing COVID-19. We use a four-quadrant conceptual framework to categorize and discuss national differences in the containment outcomes and conclude with policy implications in government responses, strategic planning, cultural adaptability, and policy implementations for the world's continuous combat with the invisible and deadly virus.

Cultural Constructs and Their Measurements

Scholars from a variety of disciplines, including anthropology, sociology, and psychology, have been interested in and studied culture for decades. Despite its pervasiveness, ambiguity, and the great varieties of dimensions, culture is generally perceived to encompass values, beliefs, norms, and other components that guide and affect human behaviors in a society. In aggregate, individuals' behaviors form and reinforce a nation's culture. When the world is in crisis, government in each country takes action, but prevailing national cultures could help shape citizens' responses and in turn lead to significantly different outcomes.

Two streams of psychological research have motivated us. First, Geert Hofstede's construct of national cultural dimensions shows that a nation's culture on a particular value dimension is related to behavior of its nationals. As an organizational psychologist, he initially studied how employees from different nations and disciplines perceived four culture-related

dimensions – power distance, uncertainty avoidance, individualism–collectivism, and masculinity–femininity and then evolved them into six dimensions of national cultures (Hofstede 1980; 1983; 2001; Hofstede *et al*., 2010). Among them, the individualism–collectivism dimension stands out to be the most relevant to our study for its utility in explaining and predicting cross-national differences in behavior (Fischer *et al*., 2009). The second is a cultural psychological one, starting with an observation by Michele J. Gelfand (2020) that "tightly controlled societies, like Singapore's, have done a better job of containing the new coronavirus than 'loose' societies, like Italy and the United States." A pioneer in the study of cultural tightness and looseness, Gelfand has, along her colleagues, developed indexes to measure variations of cultural tightness–looseness across 33 nations and 50 America's states (Gelfand 2018; Gelfand *et al*. 2011; Harrington and Gelfand, 2014).

***The individualism–collectivism dimension*.** Among Hofstede's six cultural dimensions, individualism–collectivism is the most frequently used one and has the greatest predictive power (Taras *et al*., 2012). Specifically, the individualism–collectivism dimension denotes the extent to which an individual sees themselves primarily as an autonomous entity (individualism) or embedded in a closely connected group (collectivism). A collectivist culture prioritizes meeting an individual's social role in a group over their personal fulfilment. On the contrary, an individualist culture refers to a situation in which an individual acts on their own interest assuming no social belonging and obligation and no intention to protect the interests of other members in return for their reciprocal treatment (Miller *et al*., 1990; Hofstede, 2001).

Moreover, loose ties between individuals in the individualist culture makes it less likely to punish a rule breaker who adheres to the individualist cultural ideal of autonomy, and doing so

may enhance the rule breaker's status culturally (Stamkou *et al*., 2019). However, pervasive social norms and less tolerance of deviance in the collectivist culture demand strong sanctions for anyone defying their duties and obligations as a group member. These also are applicable to nations, which differ because of variations in their cultures being individualist or collectivist. When there is a crisis, deviation and irresponsible and irrational behavior are more likely to occur in nations where individualism prevails.

The individualism–collectivism measure was one of the four cultural dimensions in Hofstede's original work (1980). Hofstede employed a standardized factor analysis based on data gathered from some 116,000 questionnaires containing 150 questions administered for two periods of 1967 to 1969 and 1971 to 1973 to IBM employees in more than 40 overseas subsidiaries. For reliability and validity considerations, he only used questions showing a correlation score higher than 0.5 to calculate the scales and controlled bias from occupational positions. Hofstede's study was eventually replicated and extended to cover 6 dimensions for 76 countries and regions (Hofstede *et al*., 2010, pp. 34–36). The quantification of cultural traits based on large sample sizes makes Hofstede measures a popular source of empirical studies. While there have been debates on and critiques of Hofstede's cultural dimensions regarding the internal validity of the dimensions, subsequent studies have largely confirmed their value and validity at the national level. For example, in 2014–2016, through analyzing new data from large probabilistic samples with 52,974 respondents from 56 countries, Minkov *et al*. (2017) proposed a new national individualism–collectivism index, which was strongly correlated with Hofstede's original measures.

Cultural tightness–looseness. Standing on the shoulders of other scholars (Pelto, 1968; Triandis, 1989), the cultural psychologist Gelfand and her colleagues have developed the cultural tightness–looseness construct (Gelfand *et al*., 2006; 2011; Gelfand 2018). The cultural tightness comes from "the strength of social norms" and "the strength of sanctioning" (Gelfand *et al*., 2006, p. 1226). Those cultures that "have strong norms and a low tolerance of deviant behavior" are defined "tight" and those having "weak norms and a high tolerance of deviant behavior" "loose" (Gelfand *et al*., 2011, p. 1100).

Having realized that cultural tightness–looseness is "part of a complex, loosely integrated system that involves processes across multiple levels of analysis" (Gelfand *et al*., 2011, p. 1102), along with colleagues, Gelfand has further developed a multilevel model of tightness–looseness. The cultural tightness–looseness could be examined at three levels: the micro or individual/community level, the meso or regional/city/provincial/state level, and the macro or national level. This is exactly what cultural psychologists have been exploring. Based on a survey in 33 nations, for example, Gelfand *et al*. (2011) pioneered the quantitative measurement of cultural tightness and looseness, or a "Gelfand Tightness Index." Scholars have used the "Gelfand Tightness Index" to study effective leadership (Aktas *et al*., 2015); changing American culture (Jackson *et al*., 2019); innovation, urbanization, and happiness in China (Chua *et al*., 2019), among others. Most recently, Gelfand *et al*. (2020) expanded their coverage of nations to 57.

Meanwhile, unsatisfied with the problem of "unrepresentative samples" in the development of the "Gelfand Tightness Index" (Uz, 2015, p. 1103), Irem Uz, also a cultural psychologist, explored the European Values Study Group and World Values Survey Association (EWVS) integrated dataset and used a dispersion-based measure as an alternative approach to

measure the cultural tightness and looseness in 68 countries. Such a "Uz Tightness Index" has advantages over the "Gelfand Tightness Index" for cross-nation comparative analysis as it resulted from surveys of a larger number of respondents (101,172 versus 22,863) and it covered more countries (68 versus 57). This enhanced index has three sub-indexes – domain specific, domain general, and combined – so as to be more comprehensive, which was also later cross-validated (Uz, 2018). The "Uz Tightness Index" has drawn considerable scholarly attention and has been used in multiple empirical studies (Thomson *et al*., 2018; Fischer *et al*., 2019).

Each of the research streams has its merits in explaining how nations' differences manifest in cultures. Cultural tightness and individualism are not mutually exclusive but distinctive (Harrington and Gelfand, 2014). It occurs to us intuitively that we may borrow, and indeed integrate, or humbly reintegrate by following Hofstede (1983), both constructs for our purpose. Together, they serve as a theoretical lens to guide our analytical approach while the COVID-19 pandemic, as a natural experiment, provides us with real-time global data for theorizing and testing.

Data, Methodology, and Findings

We employed correlation and hierarchical multiple regression approaches for empirical analysis. In data preparation and research design, we paid special attention to measurement equivalence and systems thinking (George *et al*., 2020). We used multiple indicators to measure the outcomes of the COVID-19 containment, as no single measure could fully capture the complexity in assessing the effectiveness of national responses to the pandemic. Besides the major cultural indicators, we also controlled several important variables to check how national cultures exerted their impacts.

Dependent variables: The containment outcomes. The effectiveness of slowing the spread of COVID-19 can be traced by monitoring increases in cases and deaths as well as mortality rate over a certain period. However, simply setting up a starting date and a cut-off date for all nations would be inappropriate. As a worldwide public health emergency, the coronavirus pandemic struck nations in sequence rather than in parallel and governments' reactions to the pandemic also happened in an asynchronous pattern, thus raising challenges in data preparation for a comparative study across nations under government interventions to mitigate or stop the virus.

To ensure a comparison of national performances in the COVID-19 containment at the same phase of government intervention, we chose a benchmark date of 15 days after a nation's lockdown. This was not a fully arbitrary choice but based on several characteristics of the COVID-19 transmission. First, existing studies indicated that the average time from onset of symptoms to death was 15.4 days for COVID-19 patients (Guan *et al*., 2020). Second, COVID-19 has an incubation period up to 14 days and a 14-day self-quarantine policy had been widely implemented for individuals with a COVID-19 exposure. Third, it takes time for government interventions intended to change people's lifestyles to be reasonably effective. Therefore, a buffer of 15 days seems reasonable for citizens to learn and get used to the new abnormal situation. Given that the duration of the COVID-19 evolution varied greatly across nations, a short period of one or two weeks may be inadequate to capture the effectiveness of containment efforts. For comparison, we decided to use a "30-day timeframe between the 16th and the 45th days into the implementation of a lockdown" (hereafter referred to as "the allotted 30-day period") in each country and traced changes accordingly.

The increases can be quantified either by absolute change in numbers, measured by the difference between observed values at the starting and ending days of the period, or by relative

change in percentages, measured by absolute change divided by the initial value at the starting day. Different assumptions of growth patterns underlie these measures. The increase in numbers assumes a linear growth and the percentage change is tied to an exponential pattern. When little or no actions were taken to mitigate a pandemic, the case/death growth pattern would be exponential. Even with government intervention, during the early period of a pandemic, the number of infected cases and deaths would still very likely grow exponentially. However, since our study traces the case/death changes in a nation starting from 15 days after a lockdown, the effort on "flattening the curve" should have already been effective and, thus, the linear assumption better captures the reality than the exponential one. A visual inspection of growth patterns of cases and deaths per million population (p.m.p.) during the allotted 30-day period in our sample nations confirmed that the growth pattern in most of the countries under study was linear or close to linear (see Figure 1).

[Figure 1 here]

Figure 1 also illustrates how nations differed in the growth in cases and deaths p.m.p. during the period. We used three popular public health indictors to measure performance in slowing the virus contagion in a country:

- *Increase in the prevalence rate (ΔPR)*: Measured by the increase of reported cases p.m.p. during the allotted 30-day period;
- *Increase in the crude mortality rate (ΔCMR):* Measured by the increase of reported deaths p.m.p. during the allotted 30-day period; and

- *Case fatality rate (CFR)*: Measured by the increase of reported deaths from COVID-19 divided by the increase of infected cases during the allotted 30-day period.

These three simple, straightforward, and practical indictors jointly reflect a comprehensive picture of a country's containment efforts. The lower their values, the higher the effectiveness of a nation's containment efforts.

Our data on COVID-19 infected cases and deaths were derived from "Our World in Data" (https://ourworldindata.org/coronavirus-data, accessed 27 May 2020. Lockdown dates for all but six countries in our sample were retrieved from "Global COVID-19 Lockdown Tracker" (https://auravision.ai/covid19-lockdown-tracker/, accessed 05/10/2020) and those of the remainder from a BBC News article (Dunford *et al*., 2020).

For the sake of robustness of data analysis, we scrutinized normality of the three dependent variables. Histograms of distributions of these variables showed that they were all highly positively skewed. Even with log-transformation, one dependent variable still failed the Shapiro-Wilk normality test ($p<0.05$). We then used the Van der Waerden's formula to obtain normalized scores for all three dependent variables.

***Independent cultural variables*.** As indicated, there are two indexes – the "Gelfand Tightness Index" and "Uz Tightness Index" – to measure cross-national cultural tightness–looseness. While both have proven to be valid in empirical testing, we adopted the "Uz Tightness Index" mainly because it covers more countries.

We calculated a combined tightness–looseness index based on the three components of the "Uz Tightness Index," namely the cultural tightness and looseness domain specific (CTL_DS), the cultural tightness and looseness domain general (CTL_DG), and the cultural

tightness and looseness combination (CTL_C). While all nations in our sample had CTL_DS scores, several were with missing scores for CTL_DG (Saudi Arabia and Singapore), or CTL_C (Pakistan), or both (China and Venezuela). Faced with a tradeoff between ensuring data accuracy by excluding nations with missing scores and maintaining a sample size by estimating the missing values, we chose sample size over accuracy because keeping the sample size as adequate as possible would be critical to the reliability of regression analysis. Estimations of the missing values were based on simple linear regressions of CTL_DG and CTL_C on CTL_DS using data for our sample nations (CTL_DG=14.825+0.896*CTL_DS, R^2=0.581, n=53; CTL_C=14.937+0.760*CTL_DS, R^2=0.523, n=54).

The combined cultural tightness–looseness index (hereafter "the tightness index") was calculated using the Principle Component Analysis (PCA) factor loading weighted average of the above three variables. The PCA with Varimax rotation indicated that the tightness index explained 85.6% of the total variance. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.736 and Bartlett's test of sphericity was significant ($\chi^2_{(10)}$=118.8, p<.001). Factor loadings for CTL_DS, CTL_DG, and CTL_C were 0.897, 0.946, and 0.931, respectively. The Cronbach's alpha was 0.915, showing excellent internal consistency among the three variables. Thus, the combined tightness index is deemed a good composite measure. In addition, this approach allowed for retaining the scale metric and made it easy for interpretation. All values of the tightness index in our sample were between 0 and 100, with a culturally tightest nation having a score of 0.

The individualism–collectivism measure (hereafter "the individualism score") was taken from Hofstede's six-dimension national culture index. We retrieved the individualism score from the Hofstede Insights website at https://www.hofstede-insights.com/ (accessed 10 May

2020). The individualism measure is on a scale of 1 to 100 with a higher score indicating a more individualist national culture.

Significant relationship between individualism and tightness (our sample data indicated r=0.531, p<0.01) implies an interaction effect between the two and their interaction may also contribute to the Covid-19 containment under government intervention. An interaction variable was thus created as the third cultural variable.

***Control variables*.** Many social, political, economic, demographical, and environmental factors may be considered as potential confounding variables that significantly contribute to the spread of COVID-19. Measures of public health such as death rate, mortality, and life expectancy (Marmot, 2005), of socio-economic status, such as GDP, GDP per capital, and income disparity (Kawachi and Kennedy, 1999), and of demographics such as population density, population age structure (Ferguson *et al*., 2006; Kucharski *et al*., 2014) could potentially determine the effectiveness in combating a public health emergency. Given our relatively small sample size, we limited our control variables to the following three:

- *Stringency of government responses to COVID-19*. We adopted the Oxford's daily government stringency index, a synthesis of information on daily government responses to COVID-19 in nine categories, including school closure, workplace closures, travel bans, cancellation of public events, and social distancing. The index is measured on a scale of 1 to 100. We calculated the overall government stringency index value as the average of index values during the allotted 30-day period for each country. This index is about what governments in different countries wanted their

citizens to follow and therefore it is not an evaluation of the appropriateness or effectiveness of a country's responses.

- *Median Age*. We used median age to measure life expectancy in a nation. Countries with higher median ages have a higher proportion of elderly people. It has been widely reported that elderly people are most vulnerable to COVID-19.
- *Population Density*. We used number of people per square kilometer.

The Oxford's daily government stringency index was downloaded on the website https://covidtracker.bsg.ox.ac.uk/ (accessed 26 May 2020) and data of median age and population density were retrieved form "Our World in Data" (https://ourworldindata.org/coronavirus-data, accessed 27 May 2020).

With constraints in data sources, our sample includes 55 nations that have data available for all variables. Table 1 lists sample nations with their tightness index, individualism, three control variables, as well as calculated values of ΔPR, ΔCMR, and CFR for each country during the allotted 30-day period.

[Table 1 here]

Overall, we expected the tightness index, individualism score, and the interaction between the two to be all positively related to the containment of COVID-19 measured by ΔPR, ΔCMR, and CFR. A higher tightness score refers to a looser society. This looseness characteristic thus may lead to significant variations in people's behavior in following government orders to mitigate the coronavirus. Similarly, people of a society that values collective efforts tend to strictly comply with government restriction instructions and

recommendations, while individualist persons likely pay more attention to themselves and their immediate family members. The interaction between cultural tightness and individualism reinforces each other and may therefore hinder the viral containment efforts.

***Findings*.** Prior to the multiple regression analysis, we checked descriptive statistics and the Pearson correlations between paired variables (see Table 2). The tightness index and individualism score were both significantly related to all three dependent variables. The linear relationship between our cultural variables and the effectiveness of containing the spread of COVID-19 is visualized in Figure 2 as results of our baseline models. We observed that looser or more individualist nations had higher values of increase in prevalence rate (PR), crude mortality rate (CMR), and case fatality rate (CFR), which is consistent with our expectation. A comparison of R^2 values of all six baseline models indicated that explanatory power of cultural variables was the highest for change in CMR and the lowest for CFR, and individualism had better explanatory power than tightness in accounting for variations in all three dependent variables.

[Table 2 and Figure 2 here]

We then proceeded with hierarchical regressions to check the effects of the three cultural variables controlling for the stringency of government intervention, population density, and median age. Vietnam was excluded from the modeling because it acted as an outlier in regression analysis due to its extremely low value of infected cases and zero death count during the period of interest. Regression results are summarized in Tables 3 to 5.

[Tables 3 to 5 here]

As Tables 3 to 5 indicate, among the three control variables, median age and population density exerted their significant impacts on ΔPR, ΔCMR, and CFR. The contribution of median age was consistently positive, indicating that the elderly not only were more vulnerable to the infection but also had higher mortality rate than the young and middle-aged people. Interestingly, empirical results show that a higher population density would lead to higher ΔPR but lower ΔCMR and CFR. Further investigation is needed to fully reveal the causal relationship of this phenomenon. One possible explanation is that, while higher population density is associated with more human-to-human interactions which increase the chance of infection, it also could mean more convenient access to healthcare infrastructure for people in need of medical treatments. Despite the fact that there are high population density areas with insufficient healthcare resources, previous research found no significant relationship between population density and standard of living at the national level (Boulhol and de Serres, 2010). Accordingly, we postulate that a nation's population density has no significant relationship with its density of medical resources measured by the number of nurses, doctors, and hospital beds per unit of population. Other factors held constant, on average, people in nations of higher population density would take shorter trips for a doctor's visit to receive timely diagnosis and treatment.

Surprisingly, we found that the stringency of government response to COVID-19 did not show significant relationship with ΔPR, ΔCMR, or CFR. This means that variations in how government tackled COVID-19 in enforcing restrictions was not deterministic to cross-nation variations in the virus's spread. Indeed, the stringency index measures neither the

appropriateness nor effectiveness of those policies. Rather, it merely indicates what actions that governments in different nations had taken. Whether those measures can effectively contain the pandemic is up to how they had been implemented. Descriptive statistics shows that the index has a high mean value of 79 and a relatively low standard deviation of 13 (see Table 2), suggesting that in general governments' policies across nations were very strict and without much variation.

Thus, the effectiveness of the policies is largely up for other factors, such as cultures, to explain. Our arguments that cultural factors have significant impacts on the spread of coronavirus have been verified by the empirics. For ΔPR and ΔCMR, both cultural tightness and individualism measures significantly contributed to outcomes of the coronavirus containment. Loose and individualist nations experienced a higher rate of increase in infected cases than those with tight and collective cultures.

The interaction between tightness and individualism is a significant predictor for ΔCMR but not for ΔPR. In fact, our hierarchical regression results show that the total explanatory power of cultural variables is higher for ΔCMR than for ΔPR. The differences between adjusted R^2 values for model 1 and model 2 indicates that including cultural variables raised the adjusted R^2 value by 0.180 for the regression on ΔPR and by 0.225 for ΔCMR.

Although our baseline models proved that both cultural factors were significantly related to CFR, during the allotted 30-day period, when controlling for factors of government stringency, median age, and population density, neither tightness nor individualism alone showed significantly impact on the reduction of CFR. However, their interaction had a significant and positive relationship with CFR, or the two distinct cultural factors did interact to have a joint impact on the possible recovery or death for people infected by COVID-19.

Overall, cultural factors accounted for a large proportion of the explanatory power for the spread or containment of COVID-19 when controlling for the stringency of government response, median age (a proxy for life expectancy), and population density: 18% out of 50.3% for ΔPR, 22.5% out of 58.4% for ΔCMR, and 12% out of 31.6% for CFR, or our cultural variables explained a significant portion of the variation in ΔPR, ΔCMR, and CFR across countries. Therefore, actions taken to combat the spread of Covid-19 in different countries were deeply embedded in personal behavior patterns that are heavily influenced by social values, norms, morals, customs, and beliefs in these countries. In short, cultures were deterministic to the containment of COVID-19.

Collectivism–Individualism and Tightness–Looseness: Toward an Integrated Framework

The psychology literature treats collectivism–individualism and tightness–looseness as related but clearly differentiated constructs, both theoretically and empirically (Tridandis, 1989; Carpenter, 2000; Gelfand *et al*., 2006), although collectivism and tightness covary moderately (Gelfand *et al*. 2006; Gelfand *et al*., 2011). For example, tightness is about strict societal rules whose breakers would be punished whereas individualism–collectivism emphasizes an individual's fulfilling duties and obligations in a group while also being independently oriented (Stamkou *et al*., 2019).

Our empirics show that neither the individualism score nor the tightness index is sufficient to account for the differences across nations in their COVID-19 containment outcomes. Indeed, these cultural constructs are complementary rather than redundant. Both are continuous measures rather than dichotomies, meaning that each nation occupies a position on a continuum in each construct. This also gave us justification to formulate an integrated

framework by treating individualism and tightness as theoretically independent cultural constructs while also integrating them in the cross-country culture study (Stamkou *et al*., 2019). By placing nations in a cultural quadrant of tightness–looseness and individualism–collectivism, we were able to develop the two one-dimensional constructs into a two-by-two quadrant locating nations with four distinct types of integrated cultures (Gelfand *et al*., 2006), thus expanding their respective explanatory power and advantages.

By categorizing nations under study into four quadrants – loose–individualist, tight–individualist, loose–collectivist, and tight–collectivist, with 50 as cutting-off points, Figure 3 illustrates how each nation's unique culture characteristics shaped the spread of coronavirus with the bubble size representing the ΔCMR over the allotted 30-day period. Apparently, on average, bubbles (nations) in the loose–individualist quadrant had much larger sizes than those in the tight–collectivist quadrant, suggesting that governments in loose–individualist nations were less likely to have their restrictive orders fully enforced.

[Figure 3 here]

This two-by-two cultural quadrant framework turns out to be powerful in explaining differences in containment performance across nations. The 20 loose–individualist countries were mostly from economically developed Western Europe and North America, which generally had not performed well in their fight against COVID-19. The United States witnessed the largest numbers of infected cases and deaths, despite its capacity in medical research that may have helped the country to rein in the pandemic. In addition to disrespect for science and professionals and preparedness at critical organizations such as the Centers for Disease Control

and Prevention, the failure of America's war on COVID-19 also resulted from mixed signals and initial inaction in terms of federal responses, as well as delayed and less strict stay-at-home orders by state governments and undisciplined and often indifferent behavior of its citizens with creed of individualism. A recent study showed that during mid-March roughly 40% Americans did not comply with social-distancing recommendations (Moore *et al*., 2020). By comparison, Germany, whose culture is similarly loose but less individualist, was able to keep both its prevalence rate and crude mortality rate far lower than the United States despite both countries' very close scores of the stringency index of government response (see Table 1). One possible explanation is that, unlike the Americans, Germans see somebody moving too close to themselves as an intrusion into their personal space and become uncomfortable (Ferraro, 2001, p. 89), thus leading to an increased propensity for people in this nation to strictly comply with the social-distancing policy.

The loose–collectivist culture quadrant contains eleven countries, mostly from Eastern Europe and Latin America plus India. For example, we see that Russia experienced an outbreak of infected cases although its crude mortality rate remained low. Modest in both looseness and collectiveness, this nation's spirit of collectiveness is tied to disrespectfulness of privacy in public places, which Russians consider as impersonal (Alekseyeva, 2017), raising challenges for social distancing. A survey in April revealed that only 36% Russians observed the one-meter social-distancing policy (Russian News Agency, 2020). There was an initial lack of clear direction from or ignorance in the Kremlin and Russia was full of misinformation or inaccurate information on COVID-19. However, stronger responses and collective efforts at the regional and municipal levels probably made the country escape a much worse humanitarian crisis.

Among the 20 nations in the tight–collectivist culture quadrant are China, Japan, Korea, and Singapore where common cultural characteristics, such as deference to authority, collectivity orientation, conflict aversion, and emphasis on harmony, make it natural for their citizens to follow government recommendations. For example, heavily influenced by Confucianism that promotes self-discipline and dutiful conduct toward one's superiors and family members, when faced with emergencies, the Chinese are often willing to not only comply with government policy but also voluntarily take more strict measures. The COVID-19 outbreak happened to be followed by the Chinese New Year, during which the mobility of people accelerated the viral spread from Wuhan, the epicenter, to other Chinese cities and to other countries or regions until Beijing ordered rigid, bureaucratic, and infantilizing lockdowns on Wuhan and other parts of the country. For a period of 76 days, the number of times and the errands for which Wuhanese could leave homes were limited and in doing so they had to carry a signed and dated card listing the hours and reasons. Such moves proved effective: China on March 19 announced no new domestic cases of COVID-19 for the first time since the start of the outbreak and on April 8 lifted the lockdown in Wuhan.

Only three countries fall in the tight–individualist culture quadrant. Information in Figure 3 and Table 1 shows that Hungary is highly individualist but modestly tight. In fact, Hungary is culturally tighter than almost all other European nations. Early on, the Hungarian government declared a national emergency and then passed a specific Act to Contain COVID-19, granting government the authority to extend the national emergency state endlessly until a new order to end it. Meanwhile, Hungarians behaved self-disciplinarily. In the end, the successful conclusion of the first efforts against COVID-19 could be attributed to both government's taking all the necessary actions in due time and the sacrifice and discipline of the Hungarian citizens.

Conclusions and Discussions

In this article, we explored whether countries with cultural variations in tightness–looseness and individualism–collectivism led to different outcomes in curbing the spread of COVID-19. Specifically, with empirical data from 54 nations, we utilized the hierarchical regression approach to check the effects of three cultural variables – the individualism score, the tightness index, and their interaction – on the increase in the prevalence rate, increase in the crude mortality rate, and case fatality rate, counting from the 16th to 45th days after governments' restrictive measures, while controlling for the stringency of government responses to COVID-19, median age, and population density.

Not only did cultural tightness and individualism have significant impacts on the containment of the coronavirus, both cultural factors also interacted to have a joint impact on flattening the curve. Loose and individualist nations experienced higher rate of increases in infected cases and deaths than tight and collective ones. Overall, cultural factors accounted for a large proportion of the explanatory power for variations in COVID-19 containments across nations.

Our analysis also showed that the stringency of government responses to COVID-19 did not significantly explain cross-nation variations in virus containment outcomes. This does not imply that governments' interventions had no effect on the mitigation of the coronavirus. On the contrary, without timely government interventions, the entire situation would have been much worse, i.e., we would have seen continuous exponential growth of infected cases and deaths. The reality reaffirms that successful implementations of public policies for mitigating or

stopping viral transmission required both governments' determination and the public's exercise of conformity and self-control. The latter is really where national cultures matter.

***Policy implications*.** Our findings have significant policy implications as the COVID-19 threat is still looming globally. First, given the slowly changing nature of national cultures, in order to achieve a similar level of effectiveness in containing the spread of COVID-19 in nations of tight and collectivist cultures, governments of Western nations with loose and individualist cultures need to take more stringent measures to mitigate transmission of the virus. Failure to do so would lead to higher infected cases and more deaths. This has been the case in Italy, Spain, France, and the United States. The story of Argentina tells how the government could adopt far stricter policies in a loose society to battle the coronavirus. Confronted with a public health emergency, Argentina was able to enforce tight coordination between the central government, governors and mayors over lockdown measures. Table 1 indicates Argentina was one of the most stringent nations in terms of government response. Now, Argentina feels confident enough to start relaxing social-distancing rules in most of the nation except the densely populated Buenos Aires metropolitan area. In contrast, government responses in Iran were less severe than needed. When the pandemic first hit, the Iranian government rejected plans to quarantine entire cities and areas. Although a ban was announced on travel between cities only when there was an increase in the number of new cases, Iran probably loosed its restrictive measures prematurely and the country is in the risk of a COVID-19 comeback.

Second, cultural factors tend to self-reinforce overtime, leading to path dependence that locks in human behavior patterns. Although highly challenging, Western nations rooted in cultural looseness and individualism need to be more flexible and cooperative to overcome the

path dependence when emergencies like COVID-19 hit. That is, while safeguarding individual rights remains essential (French and Raymond, 2009), citizens may have to tighten up, at least temporarily, and become more self-disciplined and endure government's restrictive rules (Gelfand, 2018, p. 69). In order to do so, these governments need to incorporate cultural awareness into the formulation of national strategies for emergencies and prepare and implement interventions in a culturally adaptive way.

Third, tightening up would become most effective only when it is enforced at all levels, from national, regional/state levels, to local communities. This is true even for the tight and collectivist nations. In China, for example, community-based organizations played distinct roles in containing the coronavirus (Cheng *et al*., 2020). During the lockdown, gatekeepers were placed at every building, living community, and village to control the ins and outs of residents by checking their certificated cards and monitoring their temperatures. In contrary, in countries such as Italy and Spain, although governments issued strict intervention measures at the national and regional levels, with individualist indulgence, citizens did not necessarily follow the orders of social distancing or sheltering in place, thus leading to failure and delayed ease of the containment and the loss of so many people that was nothing less than a tragedy.

Nonetheless, as every culture has its own merits, there is neither necessity nor possibility for an overhaul of any national culture. There needs recognition that the loose and individualist cultures prove to be associated with societies that enjoy higher living standards and technological creativity (see, for example, Harrington *et al*., 2015; Chua *et al*., 2019; Jackson *et al*., 2019), although we do not mean to suggest alienating those from collectivist cultures who also enjoy their living standards and engage in technological creativity.

In short, confronted by crises such as COVID-19, a government has to make swift decisions and undertake severe and sometimes inflexible measures recognizing the necessity to maximize the interests of its citizens. However, such decisions have to be built on the government's understanding of the national culture and especially how such culture possibly effects human behavior. Indeed, it is every individual's action to comply with government's mitigation orders that is the key to the nation's performance in crises. It is also every individual's behavior and a comprehensive understanding of the cultural effects on behavior that could enhance the overall effectiveness of a culturally aware government involved in the management of emergency responses.

Limitations and Future Research. Despite our efforts in research design and data preparation, this study is not without limitations. First, there are concerns of data reliability. Numbers of infected cases are often related to how many tests have been conducted and nations vary greatly by their testing capacities and by the criteria as to who should be tested. In addition, such criteria may change as nations' test capacities expand. Nations also differ in the practice of reporting COVID-19 related deaths. Some nations only report COVID-19 deaths of people who were tested coronavirus positive. Others also report suspected deaths caused by pneumonia with symptoms of COVID-19 without test results. Besides, reporting criteria could be inconsistent even within a nation. For example, there were sudden increases of reported deaths in Wuhan, China and in New York, the United States. Second, our sample is constrained by the number of nations involved in the study of cultural tightness–looseness and individualism–collectivism. This small sample size may be also inadequate to be fully representative as no country is from Oceania and Brazil and many African countries are excluded. Future research would be greatly

enriched if the tightness-looseness index and the Hofstede's dimension measures could be updated and expanded to cover more nations.

Finally, even though we understand that many nations display enormous cultural diversities in both constructs, we were unable to account for such intra-nation differences. In particular, cultural variation does exist between races, communities, and regions within a nation (Harrington and Gelfand, 2014; Chua *et al*., 2019), and this variation did have significant impact on the containment of COVID-19. However, since we have nation as the unit of analysis, disparities within nations in these domains go beyond the scope of this paper. We also do not have sufficient information to dive into the state or regional level for their responses to the pandemic, especially how much each of the factors analyzed in the article contributed to the existence of stark differences, say, between New York and California and other states early on and to the resurgence of the virus in California but not New York later. We see this is a promising area for future research.

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Do National Cultures Matter in the Containment of Covid-19?

Table 1. Sample nations and variables

Country	ISO Code	Lckdn Date	Tight	Ind	Govt_ Strgcy	Pop_ density	Median _age	ΔPR	ΔCMR	CFR (%)
Albania	ALB	3/13/20	35.0	20	84.1	104.9	38	187.6	6.6	3.5
Argentina	ARG	3/19/20	73.4	46	97.0	16.2	31.9	101.1	5.2	5.1
Austria	AUT	3/16/20	71.6	55	75.1	106.7	44.4	638.0	52.4	8.2
Bangladesh	BGD	3/26/20	3.2	20	92.3	1265.0	27.5	81.6	1.2	1.4
Belgium	BEL	3/18/20	98.1	75	81.5	375.6	41.8	3025.8	593.2	19.6
Bulgaria	BGR	3/13/20	60.5	30	72.3	65.2	44.7	144.9	7.6	5.3
Canada	CAN	3/13/20	77.0	80	72.9	4.0	41.4	1118.4	66.4	5.9
Chile	CHL	3/19/20	82.0	23	73.2	24.3	35.4	786.3	12.0	1.5
China	CHN	1/23/20	38.2	20	77.9	147.7	38.7	34.5	1.7	5.0
Croatia	HRV	3/18/20	53.6	33	95.2	73.7	44	273.3	16.8	6.1
Czech Rep.	CZE	3/16/20	58.8	58	69.0	137.2	43.3	427.4	19.0	4.4
Denmark	DNK	3/13/20	60.2	74	75.6	136.5	42.3	1127.2	63.9	5.7
Egypt	EGY	3/19/20	2.6	25	84.3	98.0	25.3	52.9	3.5	6.7
Estonia	EST	3/12/20	51.3	60	80.2	31.0	42.7	827.0	33.9	4.1
Finland	FIN	3/27/20	66.2	63	66.1	18.1	42.8	576.3	39.5	6.9
France	FRA	3/17/20	82.8	71	90.7	122.6	42	1186.6	319.5	26.9
Germany	DEU	3/17/20	71.8	67	73.2	237.0	46.6	1095.1	66.3	6.1
Greece	GRC	3/23/20	61.8	35	83.4	83.5	45.3	87.1	6.5	7.5
Hungary	HUN	3/28/20	43.7	80	69.3	108.0	43.4	197.0	33.7	17.1
Iceland	ISL	3/15/20	42.4	60	53.7	3.4	37.3	2271.1	23.4	1.0
India	IND	3/25/20	81.9	48	95.3	450.4	28.2	39.1	1.3	3.4
Indonesia	IDN	3/26/20	3.0	14	70.7	145.7	29.3	37.8	2.5	6.6
Iran	IRN	3/24/20	23.6	41	56.3	49.8	32.4	953.5	55.6	5.8
Ireland	IRL	3/27/20	62.1	70	88.0	69.9	38.7	3019.0	237.2	7.9
Italy	ITA	3/9/20	66.4	76	92.1	205.9	47.9	2041.0	314.4	15.4
Japan	JPN	4/7/20	42.8	46	45.5	347.8	48.2	39.7	4.8	12.2
Jordan	JOR	3/18/20	3.9	30	96.9	109.3	23.2	17.7	0.3	1.7
Lithuania	LTU	3/16/20	46.1	60	74.8	45.1	43.5	60.6	0.7	1.2
Luxembourg	LUX	3/18/20	94.7	60	75.9	231.4	39.7	2369.1	100.6	4.2
Mexico	MEX	3/21/20	80.7	30	82.4	66.4	29.3	178.5	17.0	9.5
Morocco	MAR	3/19/20	6.1	46	90.7	80.1	29.6	108.9	3.5	3.2
Netherlands	NLD	3/16/20	62.6	80	79.6	508.5	43.2	1578.8	224.5	14.2
Nigeria	NGA	3/30/20	19.4	30	83.1	209.6	18.1	22.5	0.7	3.3
Pakistan	PAK	3/24/20	7.0	14	92.2	255.6	23.5	98.5	2.4	2.5
Peru	PER	3/16/20	47.8	16	94.4	25.1	29.1	1000.3	27.9	2.8
Philippines	PHL	3/15/20	39.3	32	97.2	351.9	25.2	59.7	4.2	7.0
Poland	POL	3/13/20	50.9	60	80.2	124.0	41.8	270.2	13.7	5.1
Portugal	PRT	3/19/20	67.3	27	83.7	112.4	46.2	1584.4	79.8	5.0
Romania	ROU	3/25/20	46.0	30	87.0	85.1	43	522.4	35.8	6.9
Russia	RUS	3/30/20	53.6	39	84.7	8.8	39.6	1534.5	14.1	0.9
Saudi Arabia	SAU	3/9/20	20.4	25	90.8	15.3	31.9	350.7	3.3	0.9
Singapore	SGP	4/7/20	42.2	20	84.0	7915.7	42.4	3536.0	2.1	0.1
Slovakia	SVK	3/16/20	65.8	52	76.9	113.1	41.2	193.2	4.0	2.1
Slovenia	SVN	3/14/20	74.6	27	88.5	102.6	44.5	344.4	35.6	10.3
South Africa	ZAF	3/26/20	71.5	65	86.9	46.8	27.3	126.2	2.8	2.2
South Korea	KOR	2/23/20	29.7	18	67.4	528.0	43.4	58.6	2.9	5.0
Spain	ESP	3/14/20	80.6	51	84.7	93.1	45.5	3012.5	387.8	12.9
Sweden	SWE	3/11/20	61.2	71	36.4	24.7	41	1490.9	208.9	14.0
Tanzania	TZA	3/28/20	23.3	25	50.0	64.7	17.7	8.0	0.3	3.8
Turkey	TUR	4/11/20	21.5	37	78.7	104.9	31.6	593.3	19.7	3.3
Ukraine	UKR	3/17/20	59.0	25	88.9	77.4	41.4	225.4	5.4	2.4
United Kingdom	GBR	3/24/20	74.5	89	75.9	272.9	40.8	2231.3	340.9	15.3
United States	USA	3/17/20	60.8	91	73.5	35.6	38.3	2659.2	178.0	6.7
Venezuela	VEN	3/17/20	46.0	12	82.4	36.3	29	7.0	0.2	3.5
Vietnam	VNM	3/31/20	30.7	20	74.5	308.1	32.6	0.5	0.0	0.0

Notes: Lckdn_Date=date of lockdown; Tight=the tightness index; Ind=individualism; Govt_Strgcy=stringency of government resopnse to Covid-19; ΔPR=change in prevalence rate in number of caess per million populaiton; ΔCMR=change in crude motality rate in number of deaths per million population; CFR=case fatality rate.

Table 2. Mean, Standard Deviation, and Pearson Correlations

	Variables	Mean	SD	1	2	3	4	5	6	7	8
1	Government Stringency	79.3	13.1	1							
2	Population Density	297.6	1074.8	.074	1						
3	Median Age	37.3	8.0	-.214	.070	1					
4	Tightness	51.3	25.0	-.007	-.082	.557***	1				
5	Individualism	45.4	22.4	-.241*	-.168	.441***	.531***	1			
6	Normal Score of ΔPR	0.5	0.8	-.044	.280**	.547***	.528***	.544***	1		
7	Normal Score of ΔCMR	0.0	0.9	-.119	-.160	.595***	.621***	.661***	.821***	1	
8	Normal Score of CFR	0.0	0.9	-.143	-.294**	.371***	.403***	.484***	.199	.651***	1

Notes: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. ΔPR stands for increase in the prevalence rate; ΔCMR stands for increase in the crude mortality rate; CFR stands for case fatality rate.

Table 3. Regression on the increase in the prevalence rate (ΔPR)

	Model 1					Model 2				
	B	*SE B*	β	*t*	*p*	*B*	*SE B*	β	*t*	*p*
Control Variables										
Government Stringency	.051	.109	.054	.468	.642	.070	.098	.075	.720	.475
Population Density	.223	.107	.238	2.092	**.042**	.311	.094	.332	3.297	**.002**
Median Age	.509	.109	.542	4.666	**.000**	.255	.120	.271	2.123	**.039**
Cultural Variables										
Tightness						.009	.005	.230	1.696	**.096**
Individualism						.016	.006	.369	2.821	**.007**
Tightness*Individualism						.086	.125	.076	.692	.493
df1, df2					3, 50					3, 47
F					9.413					9.937
R^2					.361					.559
Adj. R^2					.323					.503
Durbin-Watson										1.957

Notes: Bold types indicate $p<.1$; control variables have been standardized.

Table 4. Regression on the increase in the crude mortality rate (ΔCMR)

	Model 1					Model 2				
	B	*SE B*	*β*	*T*	*p*	*B*	*SE B*	*β*	*t*	*p*
Control Variables										
Government Stringency	.026	.106	.028	.249	.805	.030	.089	.032	.334	.740
Population Density	-.192	.104	-.205	-1.855	**.069**	-.115	.086	-.122	-1.327	.191
Median Age	.578	.106	.615	5.445	**.000**	.344	.110	.366	3.132	**.003**
Cultural Variables										
Tightness						.011	.005	.299	2.411	**.020**
Individualism						.013	.005	.311	2.594	**.013**
Tightness*Individualism						.230	.114	.203	2.011	**.050**
df1, df2					3, 50					3, 47
F					10.907					13.392
R^2					.396					.631
Adj. R^2					.359					.584
Durbin-Watson										1.709

Note: Bold types indicate $p<.1$; control variables have been standardized.

Table 5. Regression on case fatality rate (CFR)

	Model 1					Model 2				
	B	*SE B*	*β*	*t*	*p*	*B*	*SE B*	*β*	*t*	*p*
Control Variables										
Government Stringency	-.034	.119	-.037	-.289	.773	-.039	.115	-.041	-.338	.737
Population Density	-.298	.116	-.319	-2.570	**.013**	-.260	.111	-.278	-2.348	**.023**
Median Age	.362	.119	.385	3.041	**.004**	.248	.141	.264	1.759	**.085**
Cultural Variables										
Tightness						.008	.006	.219	1.378	.175
Individualism						.007	.006	.172	1.122	.268
Tightness*Individualism						.311	.147	.274	2.122	**.039**
df1, df2					3, 50					3, 47
F					5.312					5.075
R^2					.242					.393
Adj. R^2					.196					.316
Durbin-Watson										2.091

Note: Bold types indicate $p<.1$; control variables have been standardized.

Do National Cultures Matter in the Containment of Covid-19?

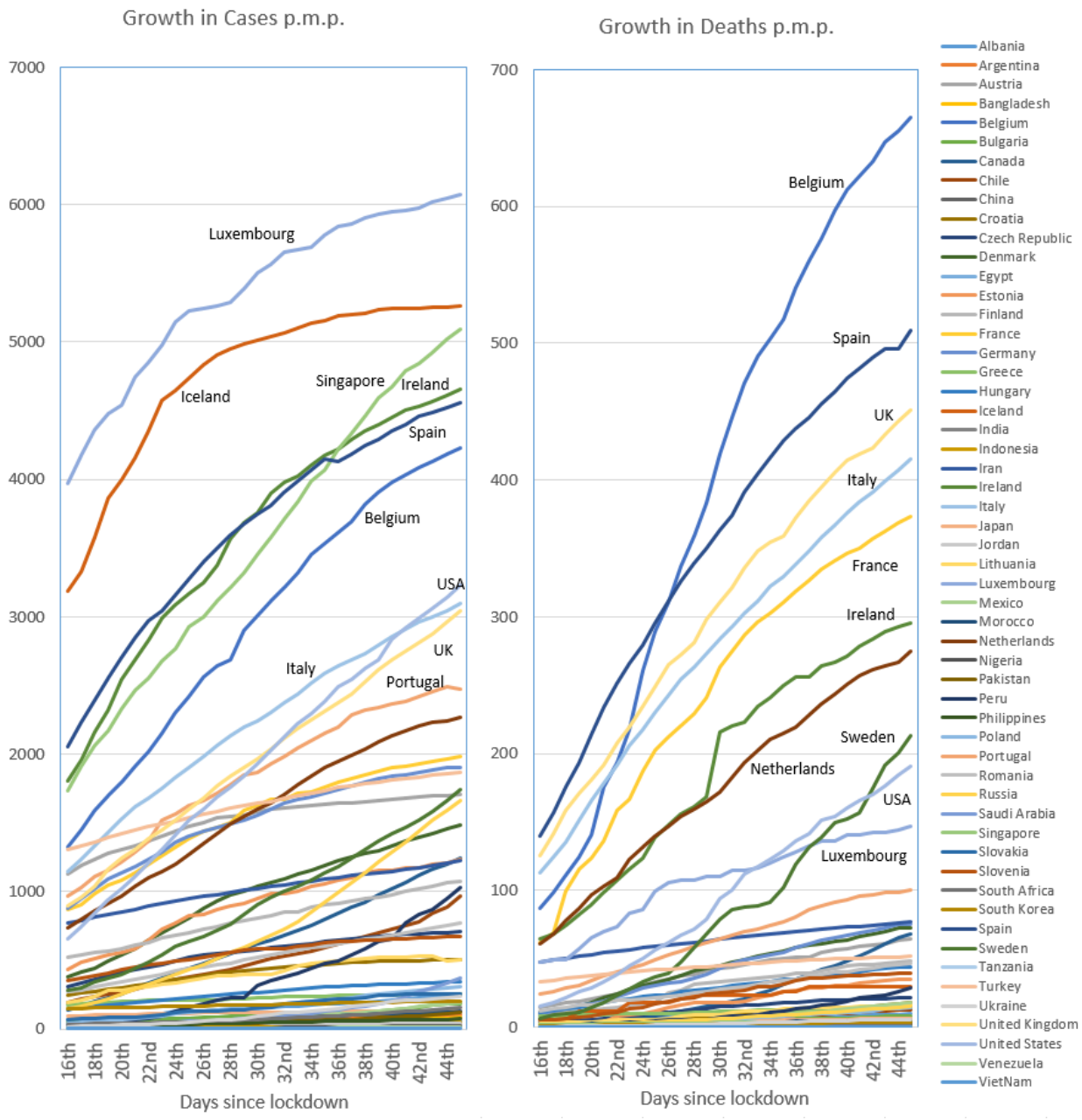

Figure 1. Growth pattern of Covid-19 cases and deaths per million population between the 16th and 45th days of lockdowns

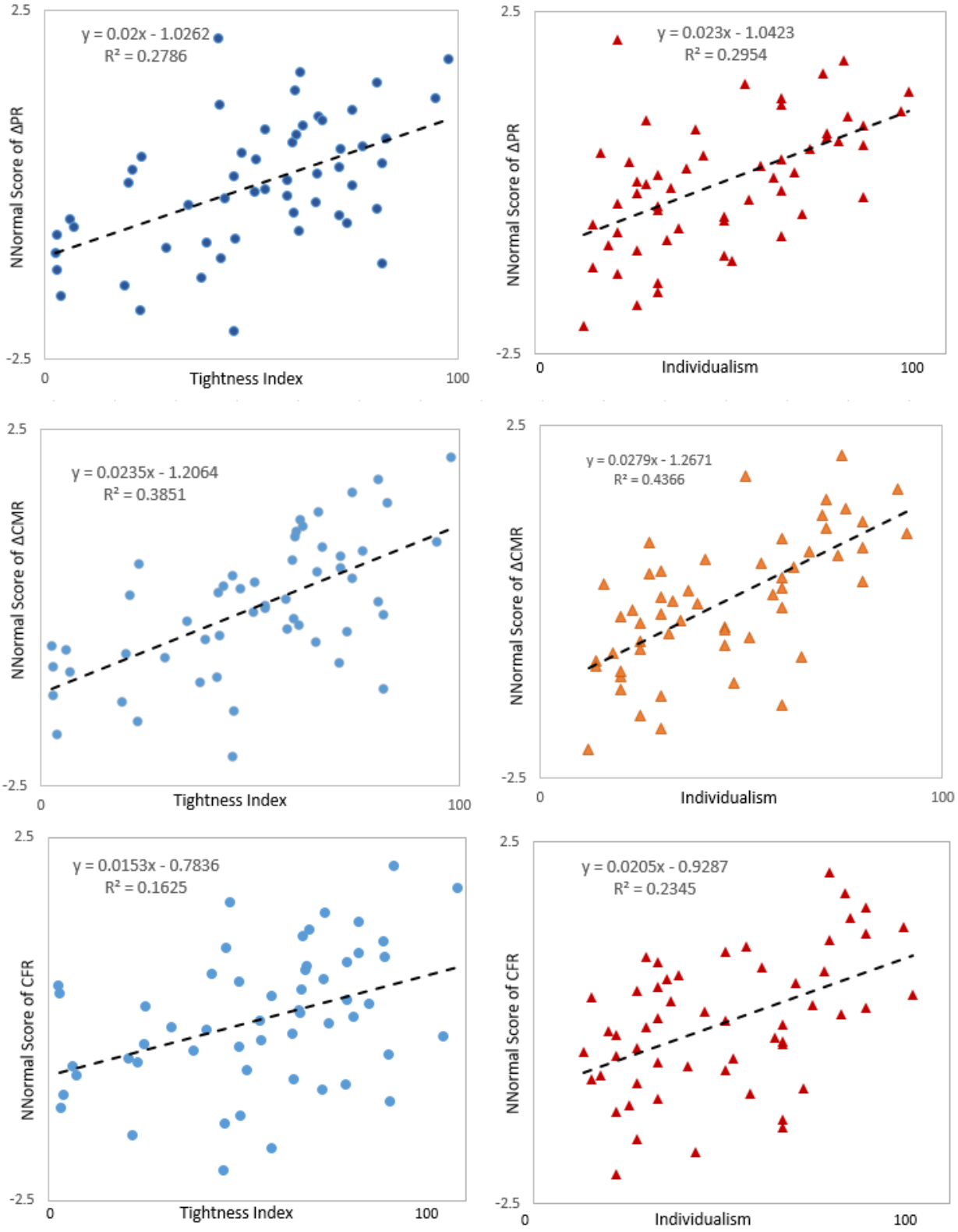

Figure 2. Cultural variables and the Effectiveness of Covid-19 Containment

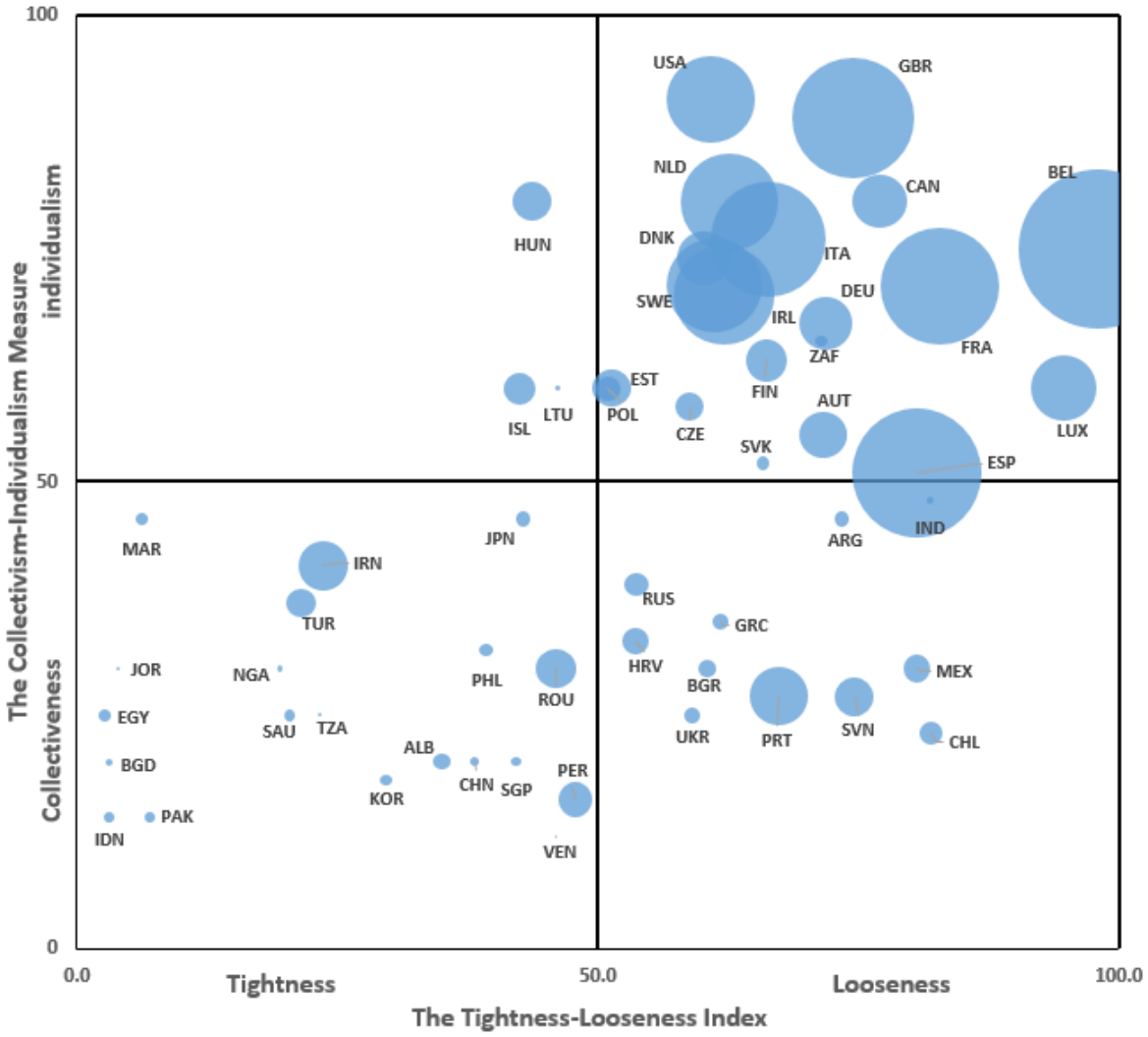

Figure 3. Comparison of nations by increase in crude mortality rate, tightness–looseness, and collectivism–individualism

Note: Bubble size measures increase of death per million population of Covid-19.