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## Full length article

## COVID-19 pandemic and stock market response: A culture effect

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## ABSTRACT

National culture has been shown to impact the way investors, firm managers, and other financial market participants respond to crisis. To date, however, none has looked at the impact of culture on stock market responses to disasters. This paper is the first to address the effect of national culture on stock market responses to a global health disaster. We find larger declines and greater volatilities for stock markets in countries with lower individualism and higher uncertainty avoidance during the first three weeks after a country's first COVID-19 case announcement. Our results are robust after controlling for investor fear, cumulative infected cases, the stringency of government response policies, the level of democracy, political corruption, and the 2003 SARS experience, among others.

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*"Every emergency reaffirms our limited understanding of hazard management—prevention, reduction, preparedness, and response; the need for systematic social science research has never been greater."*

[Everett Ressler<sup>1</sup>]

## 1. Introduction

Since news about a novel coronavirus (COVID-19) in China started appearing in early January 2020,<sup>2</sup> the global pandemic has inflicted severe loss of lives and continues to cause ongoing damage to the global economy. While virtually all countries have been affected by the pandemic, the responses to the crisis have differed markedly. Sweden, for instance, has issued very few social restrictions, while many other countries have issued varying levels of mandatory lockdowns and social distancing. Many stock markets have seen declines in excess of 30% from their recent

highs, but there has been considerable variation across countries. This raises the question of what has driven differences in investor response to the situation.

We conjecture that national culture could be an important factor. On the one hand, extant literature shows that cultural differences can explain investors' preference and tolerance for risk (e.g., Anderson et al., 2011; Chui and Kwok, 2008; Li et al., 2013), and play an important role in the way investors interpret and respond to new information (e.g., Dou et al., 2016; Schneider and de Meyer, 1991). It is, therefore, plausible that cultural values would impact how people perceive and respond to the pandemic. On the other hand, Emergent Norm Theory argues that during periods of uncertainty or danger, groups will develop new norms that will guide people's behaviors (Turner and Killian, 1987). These new norms may include the rise of antisocial behaviors such as panic buying and hoarding of food and other essential supplies. Additionally, the new norms may result in groups forming views and acting in ways contrary to that desired by governments, such as people evacuating from outside the declared evacuation area, so called shadow evacuations (National Research Council, 2006). Thus, it is equally possible that national culture may become irrelevant in driving actions during a pandemic.

We investigate the impact of national culture during the COVID-19 pandemic in this paper. Using the Morgan Stanley Capital International (MSCI) total return indices of 63 countries, we perform an event study and find that most countries in the sample experience negative returns over the first three weeks

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E-mail address: [nhut.nguyen@aut.ac.nz](mailto:nhut.nguyen@aut.ac.nz) (N.H. Nguyen).<sup>1</sup> Rodriguez, Quarantelli, & Dynes, 2007. Handbook of Disaster Research. New York, USA: Springer.<sup>2</sup> The World Health Organization (WHO) was first informed about some pneumonia cases with unknown causes in Wuhan City, Hubei Province, China, on December 31, 2019. The WHO declared the coronavirus outbreak as a Public Health Emergency of International Concern on January 30, 2020. The widespread infection and fatality of the virus led to WHO's announcement that changed the situation from an outbreak to a pandemic on March 12, 2020.

surrounding their respective countries' first infected case announcement. Interestingly, we find that the magnitude of stock market responses differs depending on a country's cultural values.

Hofstede (1980, 2001) categorizes a nation's culture based on six attributes. We focus on the two most relevant cultural dimensions shown to affect financial decision-making, individualism and uncertainty avoidance. Individualism measures the degree to which the members of society prefer a loose-knit social framework where individuals look after themselves and immediate family rather than wider groups. Uncertainty avoidance measures the degree to which a society is tolerant of uncertain outcomes. We find that countries with high individualism scores suffer a 12.71% smaller stock market decline than countries with low individualism scores by the end of week three since the first infection announcement. In addition, we find that countries with higher uncertainty avoidance scores exhibit larger stock market decreases than lower uncertainty avoidance countries by 5.40% over the same period. Our analyses on stock return volatility show that greater stock market declines are associated with greater volatility. Specifically, we find that countries with low individualism and high uncertainty avoidance have higher volatility, along with greater market declines, during the first few weeks of the COVID-19 infection.

Apart from the culture effects, we find that investor fear, proxied by the CBOE VIX and the global cumulative infected cases have a negative (positive) impact on stock market returns (volatility). We find that the stringency of government response policies intensifies the panicked response in a country's stock market; and that countries having experienced the Severe Acute Respiratory Syndrome (SARS) in 2003 are relatively more responsive to the oncoming COVID-19. We further show that the effects of the level of democracy, political corruption, and trade openness are significant on the abnormal stock returns during the first week after the infection announcement. After controlling for these effects, the relationship between culture and stock market response remains robust.

Our paper makes several contributions to the literature. First, we add to a rapidly expanding body of literature exploring the financial implications of the COVID-19 pandemic. For instance, Gormsen and Kojien (2020) find that investors' expectations regarding firms' future growth have reduced substantially, which partially explained the sharp decrease in stock markets globally. Ramelli and Wagner (2020) find that the COVID-19 effect is positive for some industries (e.g., healthcare<sup>3</sup>) but negative for some others (e.g., transportation), and that US firms with strong links to China have suffered significant economic harm. The COVID-19 also plays a significant role in earnings calls, although its impact is moderated by past experiences with an epidemic (Hassan et al., 2020). Ashraf (2020) shows the effects of government interventions during the COVID-19 on stock market returns. Unlike the above studies,<sup>4</sup> we examine how cultural values could influence the initial negative impact of COVID-19 across countries.

Second, our study contributes to the literature on the importance of culture on people's consumption behavior and financial decision-making (e.g., Brochet et al., 2019; Chui and Kwok, 2008). A growing body of literature has shown that cultural differences can explain differences in financial decision-making at the country-, firm-, and individual investor levels (e.g., Li et al., 2013; Shao et al., 2010; Tan et al., 2019). To date, however, studies have not focused on the role that culture plays in market responses

during an epidemic. The COVID-19 pandemic offers the perfect opportunity to explore the reaction to such events. Where most disasters affect just a few countries at most, the COVID-19 has affected nearly all countries, allowing us an opportunity to conduct a cross-country study.

Finally, our paper adds to the behavioral finance literature. Research shows that investors' moods and sentiment can be negatively affected by a range of events, including disasters, which in turn drive their investment decisions. For example, Dessaint and Matray (2017) show that managers of firms located in hurricane-affected areas tend to overreact and hold more cash. Dai et al. (2020) and Wang and Young (2020) show that investors and corporate managers tend to become more risk-averse following terrorist attacks. Our results show that the way in which investors react to negative events, such as disasters, is partially driven by their cultural values, i.e. investors from more individualistic countries underreact while those from more uncertainty avoiding countries overreact to disasters.

We organize the remainder of this paper as follows. Section 2 reviews related literature and develops our hypotheses. Section 3 presents our data. The empirical analyses are reported in Section 4. Section 5 concludes.

## 2. Literature review and hypotheses

A growing body of research has considered the implications of a wide range of disasters, such as terror attacks, earthquakes, and aircraft crashes on investors' and firms' financial decision-making. For instance, Broun and Derwall (2010) find that there is a very short run decrease in international stock prices following terror attacks and that the effect is more pronounced than those of natural disasters such as earthquakes. Wang and Young (2020) find that there is an increase in risk aversion surrounding terrorist attacks that they ascribe to increased fear rather than anything 'rational'. Kaplanski and Levy (2010) also find that investors overreact to aviation disasters due to an increase in perceived risk rather than an increase in actual risk.

Studies have also considered the impact of the ongoing COVID-19 pandemic. Many of them suggest that reactions to COVID-19 are driven by behavioral factors such as fear and unfamiliarity. For instance, Gormsen and Kojien (2020) find that the fall in share prices far exceeds the expected reduction in growth, implying that other factors such as a shift in risk aversion is impacting market reactions. Ramelli and Wagner (2020) document that the magnitude of the returns is too great to be driven by changes in cashflows, but rather by changes in the discount rate due to increased uncertainty. Others find that prior experience with previous outbreaks, such as SARS, impacts market reaction. Ru et al. (2020) document that countries with SARS experience react with faster and sharper drops in market prices, while Hassan et al. (2020) show that firms with SARS experience are more positive in their ability to deal with COVID-19.

Sociology literature argues that culture plays a significant role in the way different societies perceive and respond to adversity (e.g., Rodriguez et al., 2007). Studies show that values and beliefs affect the way people interpret information and the subsequent responses to that information (e.g., Brochet et al., 2019; Chui and Kwok, 2008; Nguyen et al., 2017). However, to the best of our knowledge, the literature still lacks studies that combine disaster and culture within a finance context. COVID-19 provides an ideal opportunity to explore how cross-country differences, such as culture, impact on the initial reaction to a disaster. While many disasters are relatively localized and affecting only a few countries, the COVID-19 infections have affected more than 220 countries and territories.

To investigate the impact of national culture on stock market reactions surrounding the COVID-19 pandemic, we focus on two

<sup>3</sup> Donadelli et al. (2017) examine how WHO alerts and media news on dangerous infectious diseases (SARS in 2003, H1N1 in 2009, Polio and Ebola in 2014) affect investor mood and their trading.

<sup>4</sup> Other studies that examine the various effects of COVID-19 include Albuquerque et al. (2020), and Cheng (2020).

cultural dimensions that have been widely linked to financial decision-making, individualism and uncertainty avoidance. Hofstede (1980, 2001) refers to individualism (IDV hereafter) vs. collectivism as the extent to which a society is integrated into groups, and uncertainty avoidance (UAI hereafter) as the extent to which a society accepts ambiguity and uncertainty.

Individualistic countries are marked by a focus on self-attributes or self-abilities, i.e. emphasizing personal success rather than group success. Previous studies show that individualism is highly correlated with self-attribution biases, overconfidence, and overoptimism.<sup>5</sup> Daniel et al. (1998), for example, show that investors suffering from self-attribution biases tend to overweight private information signals. The consequence of this is that as new public information arrives in the market, investors only partially adjust to the new information, and take much longer to get closer to the full information level (Dou et al., 2016). An et al. (2018) show that due to self-attribution bias, managers in individualistic countries are more likely to withhold bad news, which results in higher stock price crash risk than managers in collectivistic countries. We expect that investors from high IDV countries would therefore be more likely to underreact to the news of the first COVID-19 case within a country, resulting in a smaller negative impact.

Alternatively, Daniel et al. (1998), and Odean (1998) argue that overconfidence and overoptimism can be associated with overreaction to a salient event. Boubakri et al. (2016) document that individualism is associated with a greater willingness to take risks, while Chui et al. (2010) and Statman et al. (2006) show that high IDV is associated with excessive trading and volatility. Liu (2019) reports similar evidence at the stock market level. As a result of overconfidence, investors in individualistic countries may therefore respond more strongly, in both magnitude and volatility, to the announcement of first COVID-19 infected cases. These opposing evidence on the effect of individualism leads to our first null hypothesis below:

**Hypothesis 1.** There is no relationship between individualism and abnormal stock market return and volatility around the official confirmation of the first COVID-19 infected case(s).

Another cultural dimension that could explain how investors respond in crisis periods is uncertainty avoidance. On the one hand, the literature has linked UAI to how individuals and firm managers perceive risk and their aversion to it. Prior studies show that high UAI individuals consume more life insurance (Chui and Kwok, 2008) while firms pursue less corporate risk-taking (Li et al., 2013), require higher takeover premiums (Frijns et al., 2013), follow more conservative cash holding policies (Chen et al., 2015), and are less likely to invest in foreign markets (Anderson et al., 2011). Additionally, investors from high UAI countries are more likely to reduce their exposure to riskier markets (Inklaar and Yang, 2012). In the time of a crisis, such as the COVID-19 pandemic, this is likely to result in greater market price reductions due to an overreaction to uncertainties.

On the other hand, high UAI countries rely on very rigid social structures, laws, and other institutional frameworks. This results in more conservative and rigid-thinking individuals. The psychology literature notes that high conservatism is likely to cause an underreaction to new information as conservative investors are slow in updating their models when new information arrives (e.g., Barberis et al., 1998; Edwards, 1968). Dou et al. (2016) support this by showing that investors from high UAI countries are slow to integrate earnings announcements, resulting in greater earnings momentum. These conflicting evidence in the literature leads to our second null hypothesis as follows:

<sup>5</sup> See Chui et al. (2010) for a summary of the psychology literature in this area.

**Hypothesis 2.** There is no relationship between uncertainty avoidance and abnormal stock market return and volatility around the official confirmation of the first COVID-19 infected case(s).

### 3. Data and summary statistics

We obtain the announcement date of first infected cases and deaths in each country from John Hopkins University (JHU) Coronavirus Resource Center.<sup>6</sup> We cross-check these data with other sources<sup>7</sup> to ensure that the dates are consistent. We also extract the cumulative infected cases for each country reported in JHU, which we aggregate to obtain the global cumulative infected cases. We source culture indexes of individualism (IDV) and uncertainty avoidance (UAI) from Hofstede et al. (2010). Stock market returns are sourced from Refinitiv. We use the MSCI total return index for each country in US dollars.<sup>8,9</sup> We examine stock market response in terms of the cumulative abnormal stock market return (CAR) or abnormal stock market return volatility (AVOLA). We first calculate abnormal stock market return by subtracting stock market logarithmic return on day  $t$  by the mean of daily logarithmic returns in country  $i$  during the entire year of 2019. Our CAR for a country's stock market is computed by aggregating abnormal returns over an event window for that country, and AVOLA is the standard deviation of abnormal stock market returns over the same event window. To provide robust results, we use two different event windows of  $[-2, +5]$  and  $[-2, +15]$  days around the official infection announcement date.

After matching the Hofstede et al.'s (2010) culture with the countries with the first infected cases confirmed up to March 11, 2020, our final sample consists of 63 countries. Table 1 reports the dates on which governments confirm their first cases of COVID-19 infection and the culture indexes of IDV and UAI. A country with a high IDV score possesses a more individualistic culture. High UAI scores are for countries with higher tendency to avoid uncertain situations. The gap between the average (46.3) and median (39.0) IDV scores indicates our sample countries slightly tilts towards countries with relatively high scores in individualism, ranging from 11 (Panama) to 91 (US). In terms of UAI scores, our sample countries are relatively balanced between high and low uncertainty avoidance cultures.

On average, stock markets of the infected countries in our sample experience a 7.9% decrease in returns ( $t$ -statistic of  $-6.89$ ) within a week after the confirmation date of infection. This decrease becomes larger over time as the potential damage of COVID-19 becomes more apparent. By the end of the third week, the value of these stock markets has dropped by 22.6% ( $t$ -statistic of  $-9.15$ ). Within the first week, Bulgaria, Colombia, Luxembourg, Saudi Arabia, and Turkey were among the countries hardest hit by the coronavirus outbreak, with more than 20% decline in their stock markets. Three weeks into the infection, 60 out of 63 countries in our sample have negative abnormal returns with the largest impact suffered by Brazil, Greece, and Indonesia, with a decline in market value of more than 60%. The results for abnormal return volatility show that Argentina, Colombia, and Peru

<sup>6</sup> <https://coronavirus.jhu.edu/map.html>.

<sup>7</sup> These sources include Worldometers, <https://www.worldometers.info/coronavirus/>, Pharmaceutical Technology, <https://www.pharmaceutical-technology.com/>, and Wikipedia. Since the dates reported in different websites depend on their local time, which results in one day difference in some cases. We include 2 days prior to the report dates in our event study analysis to account for these differences.

<sup>8</sup> MSCI total return indexes in US dollars are not available for Latvia, Luxembourg, and Panama. We use the S&P Broad Market total return indexes for those three countries instead. Excluding these countries does not change our results.

<sup>9</sup> We also report the results using local currency indexes in the Online Appendix IA1.

**Table 1**  
Summary statistics.

No	Country	First Case	IDV	UAI	CAR <sub>[-2,+5]</sub>	CAR <sub>[-2,+15]</sub>	AVOLA <sub>[-2,+5]</sub>	AVOLA <sub>[-2,+15]</sub>
1	Argentina	03/03/2020	46	86	-9.4%	-40.9%	7.8%	7.9%
2	Australia	25/01/2020	90	51	-5.7%	-3.2%	0.6%	0.8%
3	Austria	25/02/2020	55	70	-11.2%	-58.9%	1.5%	4.6%
4	Bangladesh	08/03/2020	20	60	-14.2%	-8.7%	4.4%	3.8%
5	Belgium	04/02/2020	75	94	1.6%	-7.8%	1.2%	1.3%
6	Brazil	26/02/2020	38	76	-9.7%	-68.0%	3.1%	9.1%
7	Bulgaria	08/03/2020	30	85	-36.3%	-22.9%	6.7%	5.6%
8	Canada	25/01/2020	80	48	-3.2%	-1.2%	0.5%	0.5%
9	Chile	03/03/2020	23	86	-6.6%	-40.6%	3.7%	6.4%
10	China	31/12/2019	20	30	1.7%	0.7%	1.0%	1.2%
11	Colombia	06/03/2020	13	80	-45.0%	-50.5%	8.8%	10.5%
12	Croatia	25/02/2020	33	80	-2.8%	-23.7%	1.8%	3.8%
13	Czech	02/03/2020	58	74	-4.3%	-42.4%	3.3%	4.9%
14	Denmark	27/02/2020	74	23	-0.2%	-25.6%	2.2%	2.9%
15	Egypt	14/02/2020	38	68	-0.7%	-13.7%	0.8%	1.6%
16	Estonia	27/02/2020	60	60	-3.3%	-37.1%	1.7%	4.5%
17	Finland	29/01/2020	60	59	1.0%	-0.8%	1.3%	1.1%
18	France	24/01/2020	71	86	-4.5%	-3.1%	1.1%	0.9%
19	Germany	28/01/2020	67	65	-1.7%	-1.8%	1.3%	1.0%
20	Greece	26/02/2020	35	112	-11.7%	-68.5%	5.4%	6.3%
21	Hong Kong	23/01/2020	25	29	-8.7%	-5.6%	1.4%	1.3%
22	Hungary	04/03/2020	80	82	-7.7%	-31.8%	4.7%	6.8%
23	India	30/01/2020	48	40	0.0%	-0.9%	1.4%	1.0%
24	Indonesia	02/03/2020	14	48	-14.6%	-61.2%	4.5%	4.9%
25	Ireland	01/03/2020	70	35	-11.6%	-44.6%	3.1%	4.3%
26	Israel	21/02/2020	54	81	-9.3%	-32.7%	1.9%	3.7%
27	Italy	30/01/2020	76	75	3.6%	2.5%	1.4%	1.0%
28	Jamaica	11/03/2020	39	13	-11.8%	-13.8%	3.2%	3.8%
29	Japan	16/01/2020	46	92	-0.2%	-0.8%	0.4%	0.8%
30	Latvia	02/03/2020	70	63	-2.5%	-16.6%	1.8%	2.2%
31	Lithuania	28/02/2020	60	65	-1.1%	-28.6%	2.3%	4.4%
32	Luxembourg	29/02/2020	60	70	-23.66%	-59.78%	3.7%	5.0%
33	Malaysia	25/01/2020	26	36	-4.9%	-4.4%	0.7%	0.8%
34	Mexico	29/02/2020	30	82	-18.7%	-53.4%	4.7%	4.7%
35	Morocco	02/03/2020	46	68	-11.6%	-24.4%	1.8%	4.0%
36	Netherlands	27/02/2020	80	53	-4.3%	-33.8%	2.1%	3.7%
37	New Zealand	28/02/2020	79	49	-1.9%	-29.3%	2.0%	2.7%
38	Norway	26/02/2020	69	50	-7.1%	-49.6%	3.0%	4.7%
39	Pakistan	26/02/2020	14	70	-4.9%	-42.0%	1.9%	3.7%
40	Panama	10/03/2020	11	86	-17.9%	-21.5%	2.8%	3.1%
41	Peru	06/03/2020	16	87	-14.8%	-38.1%	8.0%	6.6%
42	Philippines	30/01/2020	32	44	-0.8%	-2.3%	1.8%	1.3%
43	Poland	04/03/2020	59	93	-13.6%	-28.6%	4.5%	5.7%
44	Portugal	02/03/2020	27	104	-13.9%	-38.6%	4.3%	4.8%
45	Qatar	29/02/2020	38	68	-14.3%	-10.2%	5.1%	4.1%
46	Romania	26/02/2020	30	90	-1.6%	-40.3%	3.3%	3.8%
47	Russia	31/01/2020	39	95	-6.0%	-7.0%	1.4%	1.4%
48	Saudi Arabia	02/03/2020	38	68	-20.7%	-24.9%	6.2%	4.9%
49	Serbia	06/03/2020	25	92	-13.0%	-21.1%	1.9%	2.9%
50	Singapore	23/01/2020	20	8	-4.7%	-6.0%	0.7%	1.0%
51	Slovenia	04/03/2020	27	88	-9.4%	-25.3%	3.1%	4.0%
52	South Africa	05/03/2020	65	49	-18.8%	-24.2%	5.2%	6.4%
53	South Korea	20/01/2020	18	85	-0.3%	-4.1%	1.2%	1.9%
54	Spain	01/02/2020	51	86	1.8%	-2.5%	0.8%	1.2%
55	Sweden	31/01/2020	71	29	2.7%	2.5%	1.2%	1.0%
56	Switzerland	25/02/2020	68	58	-7.2%	-26.4%	2.3%	3.2%
57	Taiwan	21/01/2020	17	69	-0.8%	-5.0%	0.1%	1.9%
58	Thailand	13/01/2020	20	64	0.9%	-8.5%	0.7%	1.1%
59	Turkey	10/03/2020	37	85	-26.6%	-30.0%	4.2%	4.1%
60	UAE	29/01/2020	38	68	-3.5%	-3.6%	0.9%	0.8%
61	UK	31/01/2020	89	35	-1.3%	-2.4%	0.8%	0.6%
62	US	21/01/2020	91	46	-2.0%	-0.4%	0.8%	0.9%
63	Vietnam	23/01/2020	20	30	-2.0%	-6.0%	1.2%	1.1%
Average			46.3	65.4	-7.9%	-22.6%	2.6%	3.3%
Median			39.0	68.0	-4.9%	-22.9%	1.9%	3.7%

This table reports the dates for the first confirmed cases. IDV is the individualism index. UAI is the uncertainty avoidance index. CAR is the cumulative abnormal return, and AVOLA is the abnormal return volatility.

are among the most volatile stock markets with daily abnormal returns swinging around 7% or more in the first week after the infection announcement. By the end of the third week, Colombia is still the most volatile stock market with a standard deviation of 10% in its daily abnormal returns. Brazil and Argentina are the second and third most volatile stock markets.

## 4. Empirical results

### 4.1. The importance of culture

We use the following regression model to examine the effect of culture on stock market response around the official



confirmation of first infected cases across countries:

$$RESPONSE_i = \alpha + \beta CULTURE_i + \gamma_1 Ln(GDPPC)_i + \gamma_2 Ln(DENS)_i + \gamma_3 Ln(CCASE)_i + \gamma_4 VIX_i + \gamma_5 GDPGRW_i + \varepsilon_i \quad (1)$$

where  $RESPONSE_i$  is either CAR or AVOLA for country  $i$ , and  $CULTURE$  is either IDV or UAI. We control for some country-specific factors such as the total value of gross domestic products per capita ( $GDPPC$ ) as a proxy for a country's economic wealth, and population density per square kilometer ( $DENS$ ) to capture the potential spread of COVID-19 within a country. We obtain these variables from the World Bank website.<sup>10</sup> The general level of fear spreading across markets globally could influence the response of investors when a government confirms the first infected cases of coronavirus in their country. To control for this, we include the cumulative infected cases ( $CCASE$ ) across all the countries globally,<sup>11</sup> and the Chicago Board of Exchange (CBOE) market volatility ( $VIX$ ), which is widely used in the literature (e.g., Baker and Wurgler, 2007; Da et al., 2015; Whaley, 2000). Both  $CCASE$  and  $VIX$  are obtained on a country's first infected case date. Finally, studies show that the pandemic effect would differ across firms and industries (e.g., Donadelli et al., 2017; Hassan et al., 2020). We therefore conjecture that the aggregate effect at the stock market level will correspond to the country's economic growth and use GDP annual growth in 2018<sup>12</sup> ( $GDPGRW$ ) from the World Bank website to account for differing effects of the COVID-19 pandemic on our sample countries.

Table 2 reports the regression results. Panel A presents the regression results using  $CAR_{[-2,+5]}$  as the dependent variable. We find that, in general, culture has a significant impact on the magnitude of stock market response to the incoming COVID-19 pandemic. Extant literature suggests that there are potentially opposing effects of individualism on investor trading behavior. On the one hand, individualistic investors are more likely to possess a self-attribution bias and overweight their private signals (e.g., Daniel et al., 1998), which results in investors underreacting to public news (e.g., Dou et al., 2016). On the other hand, there is ample evidence in the literature that individualistic investors are more overconfident and more willing to take risks (e.g., Cheon and Lee, 2018; Chui et al., 2010). This behavior would lead to excessive trading, increased volatility, and overreaction to salient events (Odean, 1998). The IDV results in Table 2 are consistent with an underreaction by individualistic investors. The positive coefficient of IDV indicates that stock markets in higher individualistic countries suffer less during the first weeks of the COVID-19 infection announcement. This effect is economically significant: moving from a country with an IDV score of 26.5 (the first IDV quartile) to a country with an IDV score of 67.5 (the third IDV quartile), the decline of abnormal stock market returns is 6.15% less severe.<sup>13</sup>

Similarly, the results for the uncertainty avoidance index are economically meaningful. For example, a country with an uncertainty index score of 85 (the third UAI quartile) would experience

<sup>10</sup> <http://datatopics.worldbank.org/world-development-indicators/>. We also control for the size of stock market as a percentage of total GDP, and stock market turnover. However, these two additional control variables are not statistically significant or change our regression results. These results are available from the authors.

<sup>11</sup> Since data from JHU starts in January 22, 2020, we source the global cumulative infected cases from Statista, <https://www.statista.com/statistics/1103040/cumulative-coronavirus-covid19-cases-number-worldwide-by-day/>. Specifically, we assign one case to China (December 31, 2019), 50 cases to Thailand (January 13, 2020) and Japan (January 16, 2020), and 400 cases to South Korea (January 20, 2020), Taiwan (January 21, 2020), and the US (January 21, 2020).

<sup>12</sup> Data for 2019 GDP growth rate is not yet available in both the World Bank and the UN National Accounts websites.

<sup>13</sup> This is calculated as  $0.15 * (26.5 - 67.5) = -6.15\%$ .

**Table 2**  
Stock market return and culture.

	Panel A: $CAR_{[-2,+5]}$		Panel B: $CAR_{[-2,+15]}$	
	IDV	UAI	IDV	UAI
<i>CULTURE</i>	0.0015*** (3.07)	-0.0007** (-2.11)	0.0031*** (3.50)	-0.0015* (-1.87)
<i>GDDPC</i>	-0.0133 (-1.55)	0.0025 (0.29)	-0.0463** (-2.11)	-0.0147 (-0.70)
<i>DENS</i>	0.0033 (0.63)	-0.0044 (-0.78)	0.0195* (1.68)	0.0038 (0.32)
<i>CCASE</i>	-0.0030 (-0.83)	0.0027 (0.78)	-0.0503*** (-3.93)	-0.0383*** (-2.98)
<i>VIX</i>	-0.0043*** (-3.87)	-0.0052*** (-4.50)	-0.0007 (-0.31)	-0.0025 (-1.01)
<i>GDPGRW</i>	0.0038 (0.87)	0.0029 (0.61)	-0.0063 (-0.61)	-0.0085 (-0.74)
<i>Constant</i>	0.1040 (1.04)	0.0712 (0.64)	0.5295** (2.07)	0.4729* (1.71)
Adj-R <sup>2</sup> (%)	46.05	39.62	43.35	38.11
Obs.	63	63	63	63

This table reports the multivariate regression results of the cumulative abnormal return (CAR). Panels A and B report the results for event windows of [-2, +5] and [-2, +15] days, respectively. *CULTURE* is either the individualism (IDV), or uncertainty avoidance (UAI). *GDDPC* is a country's gross domestic product per capita in log. *DENS* is the number of people per square kilometer of land in log. *CCASE* is the global cumulative infected cases on a country's first infected case date in log. *VIX* is the CBOE market volatility index on a country's first infected case date, and *GDPGRW* is the 2018 GDP growth. The White-corrected *t*-statistics are in parentheses.

\*\*\*Statistical significance at the 1%.

\*\*Statistical significance at the 5%.

\*Statistical significance at the 10%.

an abnormal decrease in its stock market value approximately 2.52% lower than a country with a UAI score of 49 (the first quartile UAI).<sup>14</sup> This result is consistent with the literature that suggests investors with high uncertainty avoidance trait are more risk-averse (e.g., Chui and Kwok, 2008) and hence more likely to perceive a financial risk to be much greater than investors with low uncertainty avoidance (e.g., Frijns et al., 2013). Therefore, in the event of a disease pandemic like COVID-19, uncertainty avoiding investors respond more strongly than less uncertainty avoiding investors even though they are exposed to the same information.

Panel B of Table 2 presents the regression results using  $CAR_{[-2,+15]}$  as the dependent variable. The coefficients of culture variables are approximately twice as large as those from the  $CAR_{[-2,+5]}$  regressions, indicating that the differences in abnormal returns have doubled by the end of the third week following the first infection confirmation announcement. Specifically, an interquartile increase in IDV and UAI is associated with a change in the abnormal stock returns of 12.71% and -5.40% respectively, three weeks after the official announcement of first infected cases in the country.

As for the controls, we find that population density has a positive impact while GDP per capita has a negative effect on  $CAR_{[-2,+15]}$  in the regressions with IDV. Since both global cumulative infected cases and VIX are proxies for investor fear across global financial markets while the COVID-19 is spreading, we expect them to have a negative effect on CARs. Table 2 shows that VIX is negative and statistically significant for the shorter window, i.e.  $CAR_{[-2,+5]}$ , whereas the logged value of cumulative infected cases is statistically negative for the longer window, i.e.  $CAR_{[-2,+15]}$ .<sup>15</sup> The coefficient for GDP annual growth is insignificant across all regression specifications.

<sup>14</sup> This is calculated as  $-0.07 * (85 - 49) = 2.52\%$ .

<sup>15</sup> The correlation between VIX and logged cumulative infected cases is 64%. When we drop either VIX or logged cumulative infected cases from the regressions, the other is strongly significant in both CAR windows.

**Table 3**  
Stock market return volatility and culture.

	Panel A: AVOLA <sub>[-2,+5]</sub>		Panel B: AVOLA <sub>[-2,+15]</sub>	
	IDV	UAI	IDV	UAI
<i>CULTURE</i>	-0.0003** (-2.40)	0.0002** (2.21)	-0.0003** (-2.31)	0.0002** (2.45)
<i>GDDPC</i>	-0.0004 (-0.20)	-0.0029 (-1.49)	0.0003 (0.13)	-0.0024 (-1.15)
<i>DENS</i>	-0.0016 (-1.48)	-0.0002 (-0.19)	-0.0021* (-1.67)	-0.0005 (-0.43)
<i>CCASE</i>	0.0017** (2.17)	0.0006 (0.75)	0.0036*** (3.00)	0.0023* (1.89)
<i>VIX</i>	0.0008*** (3.95)	0.0009*** (4.75)	0.0006*** (2.57)	0.0008*** (3.14)
<i>GDPGRW</i>	-0.0021 (-1.54)	-0.0018 (-1.26)	-0.0018 (-1.26)	-0.0014 (-0.92)
<i>Constant</i>	0.0178 (0.76)	0.0192 (0.75)	0.0064 (0.26)	0.0066 (0.23)
Adj-R <sup>2</sup> (%)	52.73	50.30	53.08	51.33
Obs.	63	63	63	63

This table reports the multivariate regression results of the abnormal return volatility (AVOLA). Panels A and B report the results for the event window of [-2, +5] and [-2, +15] days, respectively. *CULTURE* is either the individualism (IDV), or uncertainty avoidance (UAI). *GDDPC* is a country's gross domestic product per capita in log. *DENS* is the number of people per square kilometer of land in log. *CCASE* is the global cumulative infected cases on a country's first infected case date in log. *VIX* is the CBOE market volatility index on a country's first infected case date, and *GDPGRW* is the 2018 GDP growth. The White-corrected *t*-statistics are in parentheses.

\*\*\*Statistical significance at the 1%.

\*\*Statistical significance at the 5%.

\*Statistical significance at the 10%.

Overall, the results in Table 2 show that stock markets react more negatively for countries with lower individualism and higher uncertainty avoidance up to three weeks after the first announcement of COVID-19 infection in those countries.<sup>16</sup> These results are robust in the presence of global fear among investors and the effect of fundamentals.

Table 3 reports the results for abnormal return volatility, measured as the standard deviation of abnormal stock market returns over an event window. The regression model is the same as Eq. (1) except that the dependent variable now is either AVOLA<sub>[-2,+5]</sub> or AVOLA<sub>[-2,+15]</sub>. We find that the coefficients of culture proxies have the opposite signs to those in Table 2. For example, investors in individualistic cultures exhibit different behaviors: they respond less negatively, as shown in Table 2, when the disease pandemic is detected in their countries, and they observe small daily changes in prices, as indicated in Table 3. These results are in line with the expectation that individualistic investors are more likely to underweight public information and overweight their private signals, which leads to smaller reactions in terms of both magnitude and volatility following the confirmation of COVID-19 infection in their countries.

The positive UAI coefficient indicates that daily stock market abnormal returns for high UAI countries are significantly more volatile than those for low UAI countries during the first week and first three weeks since the first infected cases are confirmed by their respective governments. The findings indicate that investors with more uncertainty avoiding cultures react more strongly to the announcement, which resulted in higher stock price volatility, possibly indicating a more panicked response.<sup>17</sup>

Both global cumulative infected cases and VIX have a strong positive effect on stock market abnormal return volatility. The VIX

<sup>16</sup> We also use CAR<sub>[-2,+10]</sub> in our regression (1) and report the results in Panel A of Online Appendix IA2.

<sup>17</sup> We also run Eq. (1) with AVOLA<sub>[-2,+10]</sub> as the dependent variable and report the results in Panel B of Online Appendix IA2.

coefficient is statistically significant across all regression specifications in Table 3, whereas that of cumulative infection is significant in three out of four models. These results are in line with the literature that investor fear is associated with an increase in volatility in stock markets (e.g., Da et al., 2015). As for GDP annual growth and population density, the coefficients do not seem to have an impact on the abnormal volatility.

Overall, the results in Table 3 show that the volatility of daily stock market returns is higher for countries with lower individualism and higher uncertainty avoidance during the first three weeks after the first announcement of COVID-19 infection in those countries.<sup>18</sup>

#### 4.2. Other potential explanations

It is apparent that governments around the world have taken differing views on the impact that the COVID-19 pandemic could have on their countries. New Zealand, for instance, took a more decisive and stronger actions, summarized as “go hard, go early”, by quickly moving the country into a State of Emergency ‘Lock-down’ within the first three weeks since the first infected case was confirmed.<sup>19</sup> In contrast, Sweden opted not to impose any serious restrictions following its first infected case.<sup>20</sup> The impact of government policies on stock markets, however, remains unclear. On the one hand, if investors welcome such government actions, they will adjust their return expectation in a less negative manner. On the other hand, if investors consider politicians being self-serving<sup>21</sup> or that the government is overreacting, they will react more negatively (Ashraf, 2020). Given these differing views, we test whether the (in)action of a government has an impact on investors and hence the way they respond in stock markets. We use Hale et al.'s (2020) Stringency Index<sup>22</sup> (STRINGENCY) to proxy for how effective the government handles the COVID-19 risk and assess whether it is associated with stock market abnormal return and volatility.

Cepaluni et al. (2020) show that more democratic countries had less effective policy responses and suffered more deaths per capita from the COVID-19 outbreak than countries with less democratic political systems. They also find that political corruption has a negative impact on the number of deaths reported in a country. Besides, there is ample evidence in the finance literature that political system, political uncertainty, and corruption affect financial markets (e.g., Pástor and Veronesi, 2012; Santa-Clara and Valkanov, 2003; Smith, 2016). We use the Level of Democracy<sup>23</sup> (DEMO) from Teorell et al. (2020) and the Political Corruption Index<sup>24</sup> (CORRUPT) from Coppedge et al. (2020) to

<sup>18</sup> We use cumulative absolute abnormal returns (CAAR) as an alternative measure of return volatility and find results consistent with those in Table 3. We report these results in the Online Appendix IA3.

<sup>19</sup> <https://www.newshub.co.nz/home/new-zealand/2020/04/coronavirus-timeline-of-new-zealand-s-response-to-covid-19.html>.

<sup>20</sup> <https://www.thelocal.se/20200310/timeline-how-the-coronavirus-has-developed-in-sweden>.

<sup>21</sup> Mian et al. (2010), and Tahoun and van Lent (2019) show that politicians consider their private interests when they cast their votes on market intervention policies.

<sup>22</sup> This Stringency Index is based on various measures of government responses including containment and closure, economic response, and health systems. Each of the nine policy response measures is given a standardized score between zero (least strict) and 100 (most strict). The Stringency Index is the average of the nine scores. See [www.bsg.ox.ac.uk/covidtracker](http://www.bsg.ox.ac.uk/covidtracker).

<sup>23</sup> Level of democracy is the average of Freedom House and Polity. Its value ranges between zero and ten with zero being the least democratic and ten the most democratic. See Teorell et al. (2020).

<sup>24</sup> Political Corruption Index is the average of four corruption indexes for the public sector, the executive, the legislative, and the judicial. It ranges between zero and 1 with zero being the least corrupt and one being the most corrupt. See Coppedge et al. (2020).

assess the impact of the political system on the response of stock markets to COVID-19.

Countries that have experienced a disease outbreak in the past could be relatively better prepared than their peers who have not. Hassan et al. (2020) find that while firms in COVID-19 affected countries are concerned primarily about a potential adverse effect on demand, supply and market uncertainty, those that have experience with SARS in 2003 or H1N1 influenza in 2009 are better prepared and more confident in their ability to handle the COVID-19 outbreak. Additionally, Ru et al. (2020) find that stock markets in countries with SARS experience exhibited faster and more negative responses when the coronavirus broke out in late January 2020. To ensure that our results on the effects of culture are robust to such disease outbreak, we include a SARS indicator in the model, which equals one for countries that reported SARS deaths in 2003 and zero otherwise.<sup>25</sup>

Rajan and Zingales (2003) and Do and Levchenko (2007) show that a country's stock market development is driven by the level of its trade openness. During the COVID-19 pandemic, Hassan et al. (2020) and Ramelli and Wagner (2020) document that firms consider the potential impact of the COVID-19 disease on their performance domestically and internationally. To assess the effect of stock market liberalization, we employ the country's trade openness (OPEN) from the World Bank website in our baseline model. Furthermore, it is possible that during the pandemic, foreign investors repatriated capital with portfolios reallocation strategies in the home market or other asset classes. This unprecedented capital flights may result in the stock market decline. To control for this, we employ the total percentage of foreign ownership in 2017 (FOREIGN) collected from De La Cruz et al. (2019).

The effect of COVID-19 on aggregate stock markets may depend on the composition of industries in a country's economy. Ramelli and Wagner (2020) examine the coronavirus impact on US firms and find that the effect differs across industries, with the largest losers being those in the Energy, Transportation, and Automobiles industries and the best performers, including Utilities, Health Care, and Telecom. We use the value of the Services sector (SERVICE) as a proportion of a country's total GDP from the World Bank website to capture the effects of different economic structures across the countries in our sample.

Some of our sample countries report their first deaths due to the COVID-19 infection within the event windows we examine.<sup>26</sup> The salience of deaths may bias our results towards these countries.<sup>27</sup> We address this issue by including an indicator variable, DEATH, that equals one if the first death due to COVID-19 occurs during a CAR event window and zero otherwise. Finally, Table 1 shows that some countries with early confirmed first cases do not seem to respond to the potential negative impact that coronavirus has caused. To test if our results are sample specific, we use an indicator variable, OUTBREAK, that equals one after the World Health Organization (WHO) declared COVID-19 to be an outbreak on January 30, 2020, and zero otherwise.<sup>28</sup>

<sup>25</sup> We borrow this SARS death indicator from Ru et al. (2020) Appendix A2). The results are similar when we create our SARS indicator variable based on the countries with SARS confirmed cases, instead.

<sup>26</sup> Argentina, Bulgaria, Philippines, and Panama report their first COVID-19 deaths during the first week after the infection confirmation. The number of countries experiencing COVID-19 deaths increases to 31 by the end of week three since the first announcement of infection.

<sup>27</sup> Al-Awadhi et al. (2020) find that cumulative deaths have a negative effect on stock returns in the Hang Seng Index and Shanghai Stock Exchange Composite Index during the early stage of COVID-19.

<sup>28</sup> As an alternative analysis, we include in Eq. (1) an indicator variable that equals one for countries whose first official infected cases were after February 26, 2020. This indicator roughly splits our sample countries in two halves. The results are unchanged and available upon request.

We report the results for  $CAR_{[-2,+5]}$  in Table 4. In general, the effects of our culture proxies do not differ from Table 2. Table 4 shows that the IDV coefficient remains positive and significant, regardless of the inclusion of the above variables. The UAI coefficient is still negative and statistically significant across most regression specifications.

As for other potential explanations, we find that the difference in the Stringency Index between the last day and first day of the event window,  $\Delta STRINGENCY$ , has a negative and statistically significant impact on the cumulative abnormal return. This result suggests that more stringent government policies in response to the oncoming coronavirus indicate more negative sentiment or business disruptions, which is, in turn, reflected in the decline in the stock market.<sup>29</sup> The result for DEMO is positive and highly significant, suggesting that countries with more democratic political systems help stabilize the stock market downward movement better than less democratic countries during the first week of the coronavirus infection. The CORRUPT coefficient is negative and statistically significant, indicating that countries with more corrupt political systems experience larger declines in the stock markets when the COVID-19 risk becomes imminent.<sup>30</sup> The SARS indicator is negative and statistically significant in all three Panels of Table 4. This result is consistent with Ru et al. (2020) who find that stock markets in countries that experienced the 2003 SARS exhibited a larger decline than other countries when COVID-19 broke out.

We do not find significant effects of FOREIGN and SERVICE on  $CAR_{[-2,+5]}$ . However, the OPEN coefficient is negative and significant in Panel B, suggesting that countries with a more globally connected economy seem to experience larger declines when the COVID-19 spreads across the world. The effect of deaths from the COVID-19 infections, DEATH is insignificant.<sup>31</sup> Similarly, OUTBREAK is insignificant across the three Panels in Table 4, suggesting that the WHO declaration of the coronavirus outbreak does not have a differential impact on our sample countries during the first week of the COVID-19 infection announcement.

Table 5 reports that results for abnormal return volatility for  $AVOLA_{[-2,+5]}$ . The results show that all additional variables do not seem to affect the abnormal return volatility during the first week after the infection announcement. However, the culture effects are as strong as in Table 3 that countries with low individualism and high uncertainty avoidance exhibit relatively higher abnormal return volatility than countries with high IDV and low UAI.

Overall, the results in this section reinforce our findings in Tables 2 and 3 that there is a culture effect on the response of stock markets during a disease pandemic, and that this effect is robust to various country-level characteristics, government response policies, and past disease experience. In the Online Appendix IA4 and IA5, we report the results for  $CAR_{[-2,+15]}$  and  $AVOLA_{[-2,+15]}$ . In general, our culture variables, IDV and UAI, remain statistically significant, although the magnitude of their effects is economically larger for the longer compared to the shorter event window.

<sup>29</sup> We also test the separate effects of the Stringency Index components: government response index, containment health index, and economic support index. Their individual results differ depending on the regression specifications. However, the effects do not change the culture impacts we examine.

<sup>30</sup> Husted (1999) finds a positive association between the level of uncertainty avoidance in a country (measured by the Hofstede's UAI) and the level of corruption. He suggests that corruption can be viewed as a mechanism to reduce uncertainty.

<sup>31</sup> As an alternative to a DEATH indicator, we include a variable that captures the logged number of cumulative death cases for each country in the sample by the end of an event window. Nevertheless, the results for the culture proxies are qualitatively similar.



**Table 4**  
Stock market return and culture (with other possible explanations).

Culture coefficient	t-stat	Characteristics	Coefficient	t-stat	Controls	Adj-R2	Obs.
Panel A: IDV							
0.0014***	(2.87)	$\Delta$ STRINGENCY	-0.0014**	(-2.16)	YES	48.2	62
0.0013**	(2.54)	DEMO	0.0053**	(2.48)	YES	47.8	62
0.0010**	(2.02)	CORRUPT	-0.1287***	(-3.55)	YES	50.8	62
0.0015***	(3.04)	SARS	-0.0301*	(-1.88)	YES	46.1	63
0.0015***	(2.83)	OPEN	-0.0001	(-0.91)	YES	45.5	62
0.0014**	(3.11)	FOREIGN	-0.0445	(-0.49)	YES	38.7	51
0.0017***	(3.06)	SERVICE	-0.0013	(-1.31)	YES	46.0	63
0.0015***	(2.84)	DEATH	-0.0377	(-0.98)	YES	46.3	63
0.0016***	(3.09)	OUTBREAK	0.0278	(1.45)	YES	45.7	63
Panel B: UAI							
-0.0007*	(-1.85)	$\Delta$ STRINGENCY	-0.0015**	(-2.20)	YES	42.9	62
-0.0008***	(-2.81)	DEMO	0.0082***	(4.17)	YES	45.8	62
-0.0004	(-1.22)	CORRUPT	-0.1552***	(-4.36)	YES	48.3	62
-0.0009***	(-2.97)	SARS	-0.0540***	(-3.77)	YES	41.5	63
-0.0008***	(-2.56)	OPEN	-0.0003*	(-1.83)	YES	40.5	62
-0.0005	(-1.39)	FOREIGN	-0.0043	(-0.04)	YES	29.4	51
-0.0007**	(-2.10)	SERVICE	-0.0001	(-0.05)	YES	38.5	63
-0.0007**	(-2.09)	DEATH	-0.0412	(-1.14)	YES	39.9	63
-0.0008**	(-2.29)	OUTBREAK	0.0304	(1.50)	YES	39.2	63

This table reports the results for the multivariate regressions of CAR over the [-2, +5] day event window on IDV (Panel A) or UAI (Panel B) as a culture proxy.  $\Delta$ STRINGENCY is the change in Stringency Index within the event window. DEMO is the level of democracy. CORRUPT is the political corruption index. SARS is the indicator variable for countries with SARS deaths in 2003. OPEN is the ratio of a country's foreign trade over its GDP. FOREIGN is the percentage of foreign ownership in 2017. SERVICE is the value of the Services sector as a proportion of a country's total GDP. DEATH is an indicator variable which equals one when there is at least one death in a country within the event window and zero otherwise. OUTBREAK is an indicator variable which equals one after the WHO COVID-19 outbreak declaration on January 30, 2020. Other controls include GDDPC, DENS, CCASE, VIX, and GDPGRW. The White-corrected t-statistics are in parentheses.

\*\*\*Statistical significance at the 1%.

\*\*Statistical significance at the 5%.

\*Statistical significance at the 10%.

**Table 5**  
Stock market return volatility and culture (with other possible explanations).

Culture coefficient	t-stat	Characteristics	Coefficient	t-stat	Controls	Adj-R2	Obs.
Panel A: IDV							
-0.0002**	(-2.30)	$\Delta$ STRINGENCY	0.0002	(0.95)	YES	53.1	62
-0.0002**	(-2.08)	DEMO	-0.0005	(-0.68)	YES	52.0	62
-0.0002*	(-1.88)	CORRUPT	0.0112	(1.03)	YES	52.5	62
-0.0003**	(-2.38)	SARS	0.0020	(0.58)	YES	52.0	63
-0.0003**	(-2.41)	OPEN	0.0000	(-0.24)	YES	51.3	62
-0.0002**	(-2.21)	FOREIGN	-0.0027	(-0.20)	YES	57.6	51
-0.0002**	(-2.00)	SERVICE	-0.0001	(-0.56)	YES	52.1	63
-0.0003**	(-2.33)	DEATH	0.0029	(0.33)	YES	52.0	63
-0.0003**	(-2.37)	OUTBREAK	0.0006	(0.13)	YES	51.9	63
Panel B: UAI							
0.0002**	(2.05)	$\Delta$ STRINGENCY	0.0002	(1.12)	YES	51.4	62
0.0002**	(2.52)	DEMO	-0.0010	(-1.48)	YES	51.6	62
0.0001*	(1.86)	CORRUPT	0.0148	(1.44)	YES	51.3	62
0.0002***	(2.56)	SARS	0.0068*	(1.80)	YES	50.4	63
0.0002**	(2.39)	OPEN	0.0000	(0.86)	YES	48.7	62
0.0001*	(1.70)	FOREIGN	-0.0077	(-0.49)	YES	56.1	51
0.0002**	(2.16)	SERVICE	-0.0003	(-1.35)	YES	50.7	63
0.0002**	(2.17)	DEATH	0.0031	(0.38)	YES	49.6	63
0.0002**	(2.19)	OUTBREAK	-0.0004	(-0.10)	YES	49.4	63

This table reports the results for the multivariate regressions of AVOLA over the [-2, +5] day event window on IDV (Panel A) or UAI (Panel B) as a culture proxy.  $\Delta$ STRINGENCY is the change in Stringency Index within the event window. DEMO is the level of democracy. CORRUPT is the political corruption index. SARS is the indicator variable for countries with SARS deaths in 2003. OPEN is the ratio of a country's foreign trade over its GDP. FOREIGN is the percentage of foreign ownerships in 2017. SERVICE is the value of the Services sector as a proportion of a country's total GDP. DEATH is an indicator variable which equals one when there is at least one death in a country within the event window and zero otherwise. OUTBREAK is an indicator variable which equals one after the WHO COVID-19 outbreak declaration on January 30, 2020. Other controls include GDDPC, DENS, CCASE, VIX, and GDPGRW. The White-corrected t-statistics are in parentheses.

\*\*\*Statistical significance at the 1%.

\*\*Statistical significance at the 5%.

\*Statistical significance at the 10%.

## 5. Conclusion

The COVID-19 pandemic has caused severe loss of lives and damage to economies around the globe. While the effects of the COVID-19 on a country's economy and financial markets are generally negative, a question is raised as to what extent investors react to the pandemic when it is first detected in their country, and whether the reaction in a country differs from that in another country due to difference in their national culture.

Our results show that culture has a significant effect on both the magnitude and volatility of abnormal returns, and these findings are robust to a number of factors that could have an impact on stock returns. Specifically, we find that countries with low individualistic behavior and high uncertainty avoidance tendencies react more negatively and with greater volatility than countries with high individualism and low uncertainty avoidance. We further find that the stringency index based on government response policies negatively affect the cumulative abnormal returns in the country's stock market. The level of democracy, political corruption, and trade openness also exhibit significant impacts on CAR during the first week after the announcement event; and that COVID-19 has a more negative impact among investors in countries that have experienced the 2003 SARS outbreak.

While our evidence on stock market decline and volatility increase is consistent with the literature on COVID-19 (e.g., Ali et al., 2020; Ru et al., 2020), we demonstrate that culture has an important role in explaining the differences in market reactions between countries. In addition, while the effects of culture on investors' behavior during non-disaster situations have been studied (e.g., Chui and Kwok, 2008; Nguyen et al., 2017; Brochet et al., 2019), its effects on financial markets during disasters have yet been examined. Our evidence suggests that investors' culture guides their response to disasters. Finally, our findings provide guidance to regulators and policymakers on the role culture plays in stock markets when they design intervention policies in response to disasters, especially a health disaster such as the COVID-19 pandemic.

## CRedit authorship contribution statement

**Adrian Fernandez-Perez:** Empirical analysis, Discussion, Editing. **Aaron Gilbert:** Discussion, Writing, Editing. **Ivan Indriawan:** Data collection, Discussion, Editing. **Nhut H. Nguyen:** Discussion, Writing, Editing.

## Appendix A. Supplementary data

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.jbef.2020.100454>.

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