



ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Finance Research Letters

journal homepage: www.elsevier.com/locate/frl

Stock markets' reaction to Covid-19: Moderating role of national culture

Badar Nadeem Ashraf

School of Finance, Jiangxi University of Finance and Economics, Nanchang (330013), China

ARTICLE INFO

Keywords:

Covid-19
 Coronavirus
 SARS-CoV-2
 Pandemic
 Stock market
 National culture
 Uncertainty avoidance

ABSTRACT

Recent literature reports stock markets around the world reacted to the Covid-19 pandemic with negative returns. However, this reaction was not uniform across countries. In this paper, we postulate that the national-level uncertainty avoidance, which determines how sensitive members of a nation are to uncertainty, moderates the stock markets' reaction to the pandemic. Using daily data of Covid-19 confirmed cases and stock market returns from 43 countries, we find robust evidence that the decline in stock market returns in response to one percent increase in growth in confirmed cases is stronger for the countries with higher national-level uncertainty aversion.

1. Introduction

The Covid-19 pandemic has brought unprecedented uncertainty as to how deadly disease really is, when can we get a vaccine, how long do we need economic shutdowns, how governments would respond, what effects government policies will have and how people will behave (Wagner 2020). Because of such huge uncertainty, it has become quite difficult to make predictions. The price changes in asset markets showed this effect. Especially, stock markets around the world reacted to Covid-19 pandemic with unprecedented volatility and strong negative returns (Al-Awadhi *et al.* 2020; Ashraf 2020b; Baker *et al.* 2020; Ramelli and Wagner 2020; Zhang *et al.* 2020)¹. For instance, Alfaro *et al.* (2020) for the US and Ashraf (2020b) for 64 countries find that stock market returns declined in response to local Covid-19 outbreaks.

However, this market reaction was not uniform across countries and varied by the large extent (World Bank 2020). Markets reaction varied across countries not only because of different levels of expected future economic losses (Gormsen and Koijen 2020) but also due to investors' sentiment (Zhang *et al.* 2020). Investor sentiment is defined as the investor opinion about future cash flows and investment risk, or alternatively as the propensity to speculate (Baker and Wurgler 2006). Schmeling (2009) shows that the cross-country differences in cultural values influence investors' sentiment, which in turn determines investors' reaction to a news. Building on this literature, we argue that dominant national culture which determines how sensitive individuals are to uncertainty is an important sentimental factor due to which investors in different countries have responded heterogeneously to the Covid-19 crisis. Fig. 1 graphs the average correlations between stock market returns and growth in Covid-19 confirmed cases in countries with low and high uncertainty avoidance values. The negative 0.2 correlation is quite high for countries with higher uncertainty avoidance values as compared to the correlation of -0.125 for low uncertainty avoidance group.

Culture, in general, is defined as a set of shared values, beliefs and norms which distinguish the members of one society/group from others (Hofstede 1980; House *et al.* 2004). Culture guides human behaviour and determines what is acceptable or unacceptable in a

¹ E-mail address: badar@jxufe.edu.cn.

¹ Recent survey by Goodell (2020) suggests COVID-19 may have important implications for financial markets.

<https://doi.org/10.1016/j.frl.2020.101857>

Received 22 May 2020; Received in revised form 6 August 2020; Accepted 18 November 2020

Available online 20 November 2020

1544-6123/© 2020 Elsevier Inc. All rights reserved.

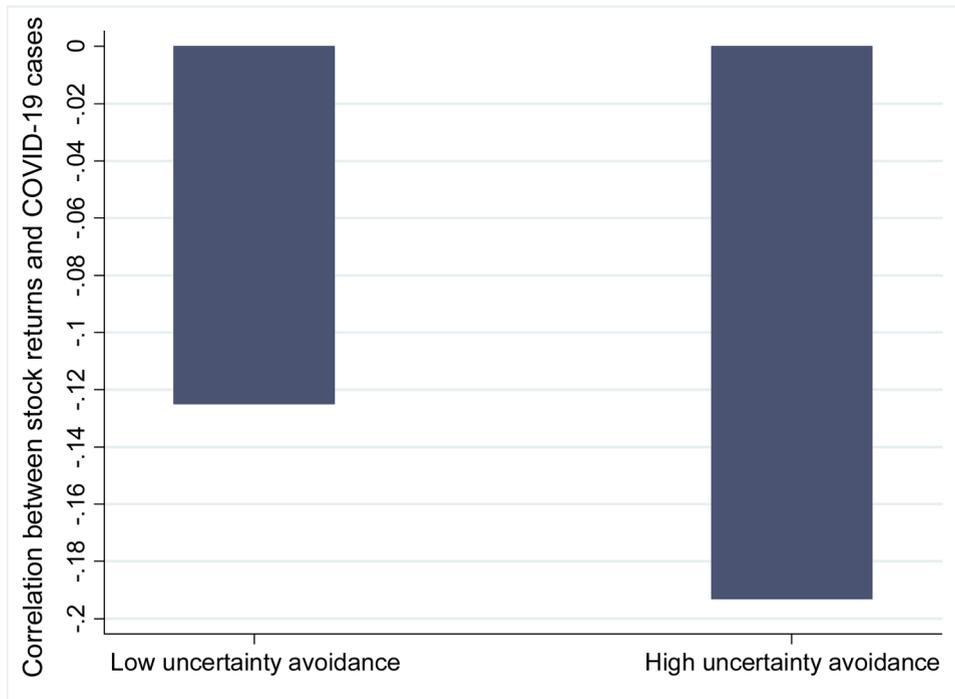


Fig. 1. The correlation between stock market returns and the growth in Covid-19 confirmed cases against the national-level uncertainty avoidance.

society (Hofstede 2001). National culture is defined as “the collective programming of the mind distinguishing the members of one nation from others” (Hofstede 1980, 2001; Hofstede et al. 2010). Though culture is a ubiquitous concept which is difficult to quantify, however for this study we consider the uncertainty avoidance dimension of national culture. Cultural psychologist (Hofstede 1980; House et al. 2004) found that uncertainty avoidance varies across countries. Recent literature suggests uncertainty avoidance dimension is the most important aspect of national culture for financial sector outcomes (Kwok and Tadesse 2006).

Specifically, we postulate that stock market investors in countries with higher level of uncertainty aversion are more likely to involve in panic selling to avoid uncertainty leading to higher negative market returns as compared to the investors in countries with lower levels of uncertainty aversion who remain calm and tolerant to risk even in the crisis.

To examine above hypothesis, we use a panel dataset of daily Covid-19 confirmed cases and stock market returns from 43 countries over the period January 22, 2020 to April 17, 2020. After controlling for country characteristics, expected future economic losses and systematic risk due to international factors, we find robust evidence that the decline in market returns was more pronounced in countries with higher level of cultural uncertainty avoidance.

We offer two important contributions to the literature: First, we complement recently emerging literature which reports stock market volatility increased and returns declined in response to Covid-19 pandemic (Al-Awadhi et al. 2020; Ashraf 2020b; Baker et al. 2020; Ramelli and Wagner 2020; Zhang et al. 2020). Our findings confirm stock market returns declined in response to Covid-19 pandemic. Second, we add to the studies which provide evidence using data from stock markets that some specific country characteristics such as the implementation of stringent government social distancing measures (Ashraf 2020a), government fiscal capacity (Gerding et al. 2020) and a country’ level of economic freedom (Erdem 2020) have provided immunity against economic losses. We add by finding that stock market reaction to the pandemic also depends on national culture. Third, we also contribute to the literature which argues that national culture is an important missing link in finance (Aggarwal and Goodell 2014; Nadler and Breuer 2019). We add by finding that national culture plays its role in asset pricing in equity markets.

The rest of the paper proceeds as follows: Section 2 introduces sample. Section 3 presents the testable hypothesis. Section 4 outlines empirical methodology. Section 5 reports empirical results. Final section concludes.

2. Sample construction

We started sample construction by collecting the data of daily Covid-19 confirmed cases from the website of John Hopkins University, Coronavirus Resource Centre (JHU-CRC) and daily stock market returns from www.investing.com website over the period from January 22 to April 17, 2020. Next, we collected country-level data of alternative measures of uncertainty avoidance from Hofstede et al. (2010) and House et al. (2004). We also collected data of other country-level control variables. We appended data of country-level cultural and other control variables with daily Covid-19 and stock returns data.

To refine the data, first, we dropped countries with missing required data. This resulted in a sample of 43 countries. Second, we

dropped observations with missing values of stock returns data, especially for weekends or national holidays, for each of the 43 countries. This led to a final dataset of 1,769 daily observations from 43 countries over the period from January 22 to April 17, 2020. We winsorized daily returns at 1% level in both tails to eliminate outliers. Table 1 lists the countries, as well as the main stock market index, the date when first Covid-19 case was confirmed (the data for any specific country in sample starts from this date) and the number of daily data observations for each country.

3. Measurement of uncertainty avoidance and testable hypothesis

3.1. Measurement of national-level uncertainty avoidance

Following recent studies (Ashraf *et al.* 2016; Ashraf and Arshad 2017), we rely on Hofstede (Hofstede 1980, 2001; Hofstede *et al.*

Table 1

Sample information.

This table reports the sample countries, the stock market index the data of which was used for a country, the date when first Covid-19 case was confirmed in a country, the number of daily data observations from each country and the country-level values of two alternative uncertainty avoidance indexes of national culture.

Sr. No.	Country	Stock index	The day when 1 st Covid-19 case was confirmed	Observations	Uncertainty avoidance (Hofstede)	Uncertainty avoidance (House)
1	Argentina	S&P Merval	Mar 03, 2020	26	86	4.62
2	Australia	S&P_ASX 200	Jan 26, 2020	57	51	3.99
3	Austria	ATX	Feb 25, 2020	35	70	3.65
4	Brazil	Bovespa	Feb 26, 2020	34	76	5
5	Canada	S&P_TSX Composite	Jan 26, 2020	56	48	3.73
6	China	Shanghai Composite	Jan 22, 2020*	54	30	5.34
7	Colombia	COLCAP	Mar 06, 2020	26	80	4.92
8	Denmark	OMX Copenhagen 20	Feb 27, 2020	32	23	4.01
9	Ecuador	Guayaquil Select	Mar 01, 2020	31	67	4.95
10	Egypt	EGX 70 EWI	Feb 14, 2020	44	80	5.24
11	France	CAC 40	Jan 24, 2020	58	86	4.65
12	Germany	DAX	Jan 27, 2020	56	65	3.7
13	Greece	Athens General Composite	Feb 26, 2020	31	100	5.16
14	Hungary	Budapest SE	Mar 04, 2020	28	82	4.74
15	India	BSE Sensex 30	Jan 30, 2020	50	40	4.58
16	Indonesia	Jakarta SEC	Mar 02, 2020	31	48	5.04
17	Ireland	ISEQ Overall	Feb 29, 2020	33	35	3.94
18	Israel	TA 35	Feb 21, 2020	34	81	4.34
19	Italy	FTSE MIB	Jan 31, 2020	53	75	4.52
20	Japan	Nikkei 225	Jan 22, 2020	58	92	4.4
21	Korea, South	KOSP	Jan 22, 2020	58	85	4.74
22	Malaysia	FTSE KLCI	Jan 25, 2020	59	36	4.81
23	Mexico	S&P_BMV IPC	Feb 28, 2020	31	82	5.18
24	Morocco	Moroccan All Shares	Mar 02, 2020	33	68	5.77
25	Namibia	FTSE NSX Overall	Mar 14, 2020	21	45	5.19
26	Netherlands	AEX	Feb 27, 2020	33	53	3.34
27	New Zealand	NZX 50	Feb 28, 2020	40	49	4.17
28	Nigeria	NSE 30	Feb 28, 2020	33	55	5.45
29	Philippines	PSEi Composite	Jan 30, 2020	51	44	4.92
30	Poland	WIG 30	Mar 04, 2020	29	93	4.75
31	Portugal	PSI 20	Mar 02, 2020	31	99	4.5
32	Russia	MOEX	Jan 31, 2020	53	95	5.26
33	Singapore	FTSE Straits Times Singapore	Jan 23, 2020	60	8	4.08
34	Slovenia	Blue-Chip SBITOP	Mar 05, 2020	27	88	5.03
35	South Africa	TOP 40	Mar 05, 2020	28	49	4.785
36	Spain	IBEX 35	Feb 01, 2020	53	86	4.8
37	Sweden	OMX Stockholm 30	Jan 31, 2020	53	29	3.45
38	Switzerland	SMI	Feb 25, 2020	35	58	3.52
39	Thailand	SET Index	Jan 22, 2020	59	64	5.71
40	Turkey	BIST 100	Mar 11, 2020	26	85	4.61
41	United Kingdom	FTSE 100	Jan 31, 2020	53	35	4.17
42	United States	S & P 500	Jan 22, 2020	59	46	3.99
43	Zambia	LSE All Share	Mar 18, 2020	17	50	4.45
	Mean/total			1769	61.47	4.55

* We start sample from the day the issue caught public eye and databases started reporting information, although China had cases well before Jan 22, 2020.

2010) and GLOBE Project (House *et al.* 2004)'s frameworks of national cultures to measure national-level uncertainty aversion of investors. Use of alternative measures of uncertainty avoidance from two frameworks would reduce measurement error and help to check the robustness of our results. Last two columns in Table 1 report the country-level values of uncertainty avoidance indexes from both frameworks.

Initially, Hofstede (1980) measured national culture using data of employees' surveys which was collected from IBM subsidiaries in 40 countries over the period 1967-1973. Later, Hofstede (2001) and Hofstede *et al.* (2010) validated and updated their data for more countries. In this framework, uncertainty avoidance index for sample countries ranges from 0 to 100, where country index value reflects the relative position of a country versus others, rather than being absolute value.

In contrast, House *et al.* (2004) collected survey data from middle-level managers working in financial services, food-processing and telecommunication services industries over the period 1994-97 to measure national culture. We use uncertainty avoidance values (should be) variable which is comparable with Hofstede's variable of uncertainty avoidance.

3.2. Hypothesis

Hofstede (1980) defines uncertainty avoidance as the degree to which members of a culture feel uncomfortable with uncertain/unstructured situations and this feeling, among other things, is expressed through a need for predictability. Individuals from cultures with higher uncertainty avoidance do not accept uncertainty easily and become upset with it (Hofstede 2001). They react quite quickly when their threat-related anxiety deviates from their comfort zone, the variance of which is quite narrow. On the contrary, individuals from lower uncertainty avoidance cultures embrace uncertainty rather easily and can tolerate higher risks in ambiguous situations. They react quite slowly when their threat-related anxiety deviates from their comfort zone, the variance of which is quite wide. Since Covid-19 is a rare event and entails enormous Knightian uncertainty (or ambiguity), where probabilities of different outcomes are unknown. Though stock markets reacted to Covid-19 with negative returns (Ashraf 2020b), however investors in countries with higher uncertainty avoidance would price uncertainty in more negative way and panic sell even at lower stock prices. Conversely, the reaction of investors with lower uncertainty avoidance would not be that strong because of higher tolerance to uncertainty. Based on this discussion our hypothesis is as follows:

H1. : Stock markets' reaction to the Covid-19 with negative returns is expected to be stronger in countries with higher cultural uncertainty avoidance as compared to the market reaction in countries with lower uncertainty avoidance.

4. Methodology

Following Ashraf (2020a,b), we specify following pooled panel ordinary least squares regression model for empirical analyses.

$$Y_{c,t} = \alpha_c + \beta_1 (COVID - 19_{c,t-1} \times Uncertainty\ avoidance_c) + \beta_2 (COVID - 19_{c,t-1}) + \beta_3 (Uncertainty\ avoidance_c) + \sum_{k=1}^k \beta_k X_c^k + \sum_{t=1}^{T-1} \epsilon_t D_t + \epsilon_{c,t} \quad (1)$$

Here, c and t subscripts represent country and day, respectively. α_c is a constant term. Y is the dependent variable and represents stock market returns in country c on day t . Specifically, daily stock market return equals $(Indexvalue_t - Indexvalue_{t-1}) / Indexvalue_{t-1}$. Building on the findings of Ashraf (2020b) that stock markets' negative reaction was significant only to the growth in confirmed cases, but not to the growth in deaths, we measure Covid-19 as the daily growth in confirmed cases. Uncertainty avoidance represents the national-level uncertainty avoidance of investors and is measured with two alternative indexes from Hofstede *et al.* (2010) and House *et al.* (2004). The interaction term, $COVID - 19_{c,t-1} \times Uncertaintyavoidance_c$, is the main variable of interest where the estimated values of coefficient, β_1 , show whether the reaction of stock market investors to Covid-19 depends on national-level of uncertainty avoidance.

X_c^k is a set of country-level control variables including investment freedom, democratic accountability and log (GDP). Since uncertainty avoidance in Eq. (1) mainly represents the uncertainty aversion of investors who are national of a country, however equity markets may also have allowed foreign investors' participation. To quantify uncertainty avoidance of these foreign investors is quite complicated task, if not impossible, because such investors might have come from different nationalities carrying diverse cultural values (Lucey and Zhang 2010; Aggarwal *et al.* 2012). Therefore, rather than to directly measure uncertainty avoidance of foreign investors, we add investment freedom index from Heritage Foundation database (Heritage Foundation 2020). This index measures stock market liberalization, including the extent of foreign investors' participation in local stock market, and acts as an ex-ante proxy to control for foreign investors' participation in local stock market.

While reacting to the Covid-19, stock market investors may also have priced in institutional and economic capacity of their countries to minimize the future expected economic losses. Therefore we include democratic accountability and Log(GDP) as control variables. Democratic accountability index is from the International Country Risk Guide database and measures the quality of political institutions. Log (GDP) equals the natural logarithm of total gross domestic product (GDP) of each country, where the data of GDP is collected from the World Development Indicators of World Bank. Lastly, we include a set of daily fixed-effects dummy variables, D_t , to control for stock markets' reaction to daily international events. These dummy variables equal 1 for a specific day and 0 for all others days, with a total of 70 dummy variables for 70 data days. These dummy variables effectively control for systematic risk due to international factors. $\epsilon_{c,t}$ is an error term. We use heteroskedastic-robust standard errors to estimate p -values in regressions.

5. Empirical analyses

This section reports empirical results. Table 2 reports summary statistics. The -0.35 mean value of stock market returns shows overall stock markets declined over the sample period. Minimum and maximum values of -0.11 and 0.08, respectively, suggest daily market returns experienced wide fluctuations. Likewise, growth in confirmed Covid-19 cases has a mean value of 17 percent with a wide standard deviation of 35 percent. Both uncertainty avoidance indexes also demonstrate considerable variation across mean values. Democratic accountability has a mean value of 4.85 and ranges from 1.5 to 6 where 1.5 indicates the lowest and 6 the highest level of democratic accountability. Similarly, investment freedom has a mean value of 67.53 and ranges from 20 to 90, where higher values represent higher investment freedom and vice versa.

Table 3 reports the Pearson correlations between main variables. The positive 0.35 correlation between uncertainty avoidance indexes indicates that they both, to some extent, represent the same construct. Correlations between other variables are also not quite high suggesting the lower chances of multicollinearity in multivariate analysis.

Table 4 reports main empirical results. As shown, the growth in confirmed cases variable enters significantly negative in model 1 confirming the findings of previous studies such as Ashraf (2020b), Alfaro et al. (2020) and Al-Awadhi et al. (2020) that stock markets responded negatively to Covid-19 outbreaks. Uncertainty avoidance also enters negative, although not significant, suggesting that the decline in stock returns was higher in countries with higher uncertainty aversion. The interaction term, $COVID - 19_{c,t-1} \times Uncertaintyavoidance_c$, enters negative and significant suggesting that the negative impact of growth in confirmed cases on stock market returns strengthens in countries with higher uncertainty avoidance. This result confirms that national culture moderates the relationship between Covid-19 confirmed cases and stock market returns.

To explain the moderating effect with interaction terms, we graph relationship between stock returns and growth in confirmed cases at mean and \pm one standard deviation of mean value of both uncertainty avoidance indexes one-by-one. Graphs 1 and 2 in Fig. 2 are drawn from models 3 and 5, respectively, of Table 4. The downward sloped lines in both graphs indicate that stock returns and growth in confirmed cases are negatively associated. However, lines with different slopes in each graph show that the negative association between stock returns and growth in confirmed cases varies at different levels of uncertainty avoidance. Specifically, the lower steeper lines in both graphs indicate that the decline in stock returns in response to one percent increase in growth in confirmed cases is stronger if the uncertainty avoidance is higher. Together, these results support our hypothesis 1.

We perform several robustness tests. First, stock market reaction tends to be stronger in early days of Covid-19 outbreak (Ashraf 2020b). However, in the above analysis, some sample countries have already passed peaks of local Covid-19 outbreaks, such as China, among others. Therefore, to get a consistent event window across countries we keep data of up to 30 days of local outbreak (starting from the day of first confirmed case) for each country. This reduces sample to 834 observations. We re-estimate Eq. (1) with this data. As shown in Table 5, the interaction terms enter negative and significant, again confirming the above main results. Second, we include additional control variables including stringency and income support indexes from Oxford COVID-19 Government Response Tracker (OxCGRT) database (Hale et al. 2020), anti-self dealing index from Djankov et al. (2008) and regulatory quality index from World Governance Indicators database of World Bank to further eliminate the concern of omitted variables. As shown in Table 6, interaction terms still enter positive and significant after including these additional controls, again confirming the main results. Third, we use panel random-effects model as an alternative estimation method and re-estimate all specifications of Table 4. In unreported results, we observe that findings largely remain same where both interaction terms enter negative and significant.

6. Conclusion

In this paper, we examine whether the national-level uncertainty avoidance moderates stock markets' reaction to Covid-19 pandemic. Using daily data of Covid-19 confirmed cases and stock market returns from 43 countries, we first confirm that overall stock markets responded to the growth in Covid-19 confirmed cases with significant negative returns. Second, we find that the decline in stock returns in response to one percent increase in growth in confirmed cases is stronger if the level of uncertainty aversion of investors is higher. Together our findings suggest that national culture is an important factor which determines the cross-country differences in investors' response to any news.

The findings of this study have important implications for financial market participants and governments. Our results imply investors overreact to the adverse shock incorporating uncertainty due to cultural biases. Further, although investors try to price in expected economic losses into share prices, however actual decline in stock markets also involves the decline due to investors'

Table 2

Summary statistics.

This table reports the summary statistics of main variables.

Variable	Observations	Mean	Standard deviation	Minimum value	Maximum value
Stock market returns	1769	-0.35	3.31	-10.53	7.82
Growth in confirmed cases	1769	0.17	0.35	0	7
Uncertainty avoidance (Hofstede)	1769	61.47	23.65	8	100
Uncertainty avoidance (House)	1769	4.55	0.61	3.34	5.77
Democratic accountability	1769	4.85	1.43	1.5	6
Investment freedom	1769	67.53	18.82	20	90
Log (GDP)	1769	27.40	1.39	23.33	30.60

Table 3

Correlations matrix.

This table reports the pairwise Pearson correlations between main variables. * indicates significance level at 10% level.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Stock market returns	1.00						
(2) Growth in confirmed cases	-0.15*	1.00					
(3) Uncertainty avoidance (Hofstede)	-0.02	0.03	1.00				
(4) Uncertainty avoidance (House)	-0.01	-0.05*	0.35*	1.00			
(5) Democratic accountability	-0.02	0.08*	0.08*	-0.60*	1.00		
(6) Investment freedom	-0.01	0.05*	-0.10*	-0.71*	0.62*	1.00	
(7) Log (GDP)	0.01	-0.04*	-0.02	-0.21*	0.13*	-0.04*	1.00

Table 4

Moderating effect of national culture on the relationship between Covid-19 and stock market returns: main specifications.

This table reports the results regarding the moderating impact of uncertainty avoidance on the stock markets' reaction to Covid-19. Stock market returns is dependent variable in all models and is measured as the daily change in major stock index of a country. Interaction terms, Growth in confirmed cases \times Uncertainty Avoidance (Hofstede) and Growth in confirmed cases \times Uncertainty avoidance (House), are main independent variable of interest. Growth in confirmed cases is measured as the daily growth in Covid-19 confirmed cases in a country. Uncertainty Avoidance (Hofstede) is the uncertainty avoidance index from Hofstede et al. (2010)'s framework of national culture. Uncertainty avoidance (House) is the value-based uncertainty avoidance index from House et al (2004)'s framework of national culture. Higher values of both indexes show higher cultural values of uncertainty aversion and vice versa. Democratic accountability is taken from International Country Risk Guide database and represents the quality of political institutions. Investment freedom is taken from Freedom House website and controls for stock market liberalization. Log (GDP) is taken for World Development Indicators (WDI) of World Bank and controls for the level of economic development. Panel pooled ordinary least squares model, with heteroskedasticity robust standard errors, is used for estimations. P-values are given in parenthesis. ***, **, * represent statistical significance at 1%, 5%, and 10% levels, respectively.

Variables	Stock market returns				
	(1)	(2)	(3)	(4)	(5)
Growth in confirmed cases	-0.400*** (0.007)	-0.398*** (0.006)	0.421 (0.191)	-0.405*** (0.005)	1.253* (0.094)
Uncertainty Avoidance (Hofstede)		-0.002 (0.333)	0.000 (0.933)		
Growth in confirmed cases \times Uncertainty Avoidance (Hofstede)			-0.014*** (0.010)		
Uncertainty avoidance (House)				-0.170 (0.180)	-0.099 (0.445)
Growth in confirmed cases \times Uncertainty avoidance (House)					-0.386** (0.046)
Democratic accountability	0.010 (0.829)	0.018 (0.695)	0.010 (0.831)	-0.005 (0.920)	-0.000 (0.993)
Investment freedom	-0.002 (0.568)	-0.003 (0.465)	-0.002 (0.517)	-0.005 (0.236)	-0.005 (0.249)
Log (GDP)	0.026 (0.559)	0.025 (0.577)	0.024 (0.585)	0.010 (0.827)	0.008 (0.859)
Daily fixed-effects dummy variables	Yes	Yes	Yes	Yes	Yes
Constant	-0.927 (0.483)	-0.748 (0.577)	-0.859 (0.521)	0.617 (0.723)	0.397 (0.820)
Observations	1,769	1,769	1,769	1,769	1,769
R-squared	0.588	0.589	0.589	0.589	0.589

sentiments driven by cultural biases. Buying stocks during market downturn in the countries with higher uncertainty aversion might be a good bet.

Author statement

Badar Nadeem Ashraf carried out this research.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.frl.2020.101857](https://doi.org/10.1016/j.frl.2020.101857).

Impact of COVID-19 Cases on Stock Market Returns: Moderating role of national culture

Predictive margins

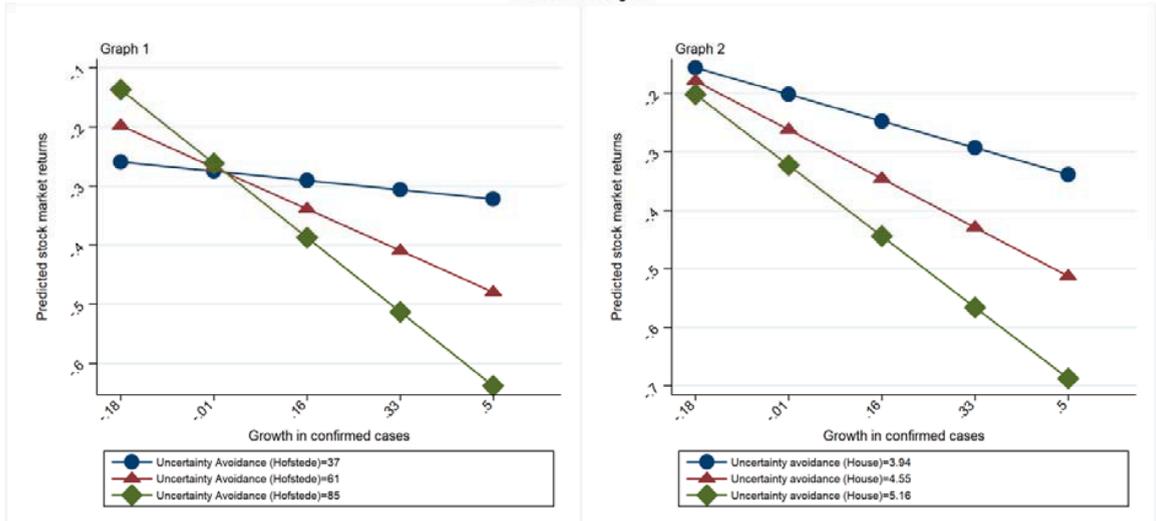


Fig. 2. The relationship between stock market returns and the growth in Covid-19 confirmed cases, depending upon different national-levels of uncertainty avoidance.

Table 5

Moderating effect of national culture on the relationship between Covid-19 and stock market returns: robustness tests with filtered sample. This table reports the results of robustness tests regarding the moderating impact of uncertainty avoidance on the stock markets' reaction to Covid-19 with filtered sample. Stock market returns is dependent variable in all models and is measured as the daily change in major stock index of a country. Interaction terms, Growth in confirmed cases \times Uncertainty Avoidance (Hofstede) and Growth in confirmed cases \times Uncertainty avoidance (House), are main independent variable of interest. Growth in confirmed cases is measured as the daily growth in Covid-19 confirmed cases in a country. Uncertainty Avoidance (Hofstede) is the uncertainty avoidance index from Hofstede et al. (2010)'s framework of national culture. Uncertainty avoidance (House) is the value-based uncertainty avoidance index from House et al (2004)'s framework of national culture. Higher values of both indexes show higher cultural values of uncertainty aversion and vice versa. Democratic accountability is taken from International Country Risk Guide database and represents the quality of political institutions. Investment freedom is taken from Freedom House website and controls for stock market liberalization. Log (GDP) is taken for World Development Indicators (WDI) of World Bank and controls for the level of economic development. Panel pooled ordinary least squares model, with heteroskedasticity robust standard errors, is used for estimations. P-values are given in parenthesis. ***, **, * represent statistical significance at 1%, 5%, and 10% levels, respectively.

Variables	Stock market returns				
	(1)	(2)	(3)	(4)	(5)
Growth in confirmed cases	-0.382** (0.027)	-0.384** (0.026)	0.632 (0.115)	-0.392** (0.023)	1.689* (0.056)
Uncertainty Avoidance (Hofstede)		-0.002 (0.444)	0.001 (0.682)		
Growth in confirmed cases \times Uncertainty Avoidance (Hofstede)			-0.016*** (0.008)		
Uncertainty avoidance (House)				-0.202 (0.301)	-0.081 (0.685)
Growth in confirmed cases \times Uncertainty avoidance (House)					-0.489** (0.033)
Democratic accountability	0.054 (0.360)	0.057 (0.337)	0.052 (0.381)	0.032 (0.612)	0.038 (0.549)
Investment freedom	-0.003 (0.588)	-0.003 (0.547)	-0.003 (0.591)	-0.006 (0.327)	-0.006 (0.352)
Log (GDP)	0.020 (0.793)	0.027 (0.735)	0.024 (0.762)	0.002 (0.978)	0.005 (0.946)
Daily fixed-effects dummy variables	Yes	Yes	Yes	Yes	Yes
Constant	-0.924 (0.680)	-0.941 (0.676)	-1.088 (0.626)	0.893 (0.754)	0.300 (0.916)
Observations	834	834	834	834	834
R-squared	0.609	0.610	0.611	0.610	0.612

Table 6

Moderating effect of national culture on the relationship between Covid-19 and stock market returns: robustness tests with additional control variables.

This table reports the results of robustness tests regarding the moderating impact of uncertainty avoidance on the stock markets' reaction to Covid-19 with additional control variables. Stock market returns is dependent variable in all models and is measured as the daily change in major stock index of a country. Interaction terms, Growth in confirmed cases \times Uncertainty Avoidance (Hofstede) and Growth in confirmed cases \times Uncertainty avoidance (House), are main independent variable of interest. Growth in confirmed cases is measured as the daily growth in Covid-19 confirmed cases in a country. Uncertainty Avoidance (Hofstede) is the uncertainty avoidance index from Hofstede et al. (2010)'s framework of national culture. Uncertainty avoidance (House) is the value-based uncertainty avoidance index from House et al (2004)'s framework of national culture. Higher values of both indexes show higher cultural values of uncertainty aversion and vice versa. Democratic accountability is taken from International Country Risk Guide database and represents the quality of political institutions. Investment freedom is taken from Freedom House website and controls for stock market liberalization. Log (GDP) is taken for World Development Indicators (WDI) of World Bank and controls for the level of economic development. Stringency index and Economic support index are taken from Oxford Coronavirus Government Response Tracker. Stringency index represents government announcements regarding social distancing measures such as closure of schools, work places and public places and restrictions on travel. Economic support index represents government announcements of income support and debt/contract relief for households. Anti-self dealing index is from Djankov et al. (2008) and measures legal protection to minority shareholders. Regulatory quality index is from World Governance Indicators of World Bank. Panel pooled ordinary least squares model, with heteroskedasticity robust standard errors, is used for estimations. P-values are given in parenthesis. ***, **, * represent statistical significance at 1%, 5%, and 10% levels, respectively.

Variables	Stock market returns			
	(1)	(2)	(3)	(4)
Growth in confirmed cases	0.485 (0.135)	0.410 (0.232)	1.304* (0.084)	1.585** (0.041)
Uncertainty Avoidance (Hofstede)	0.001 (0.799)	0.001 (0.841)		
Growth in confirmed cases \times Uncertainty Avoidance (Hofstede)	-0.015*** (0.005)	-0.014** (0.011)		
Uncertainty avoidance (House)			-0.077 (0.551)	-0.091 (0.641)
Growth in confirmed cases \times Uncertainty avoidance (House)			-0.397** (0.042)	-0.474** (0.020)
Democratic accountability	0.007 (0.880)	0.000 (0.999)	0.000 (0.993)	0.006 (0.914)
Investment freedom	-0.002 (0.651)	-0.007 (0.205)	-0.004 (0.353)	-0.007 (0.243)
Log (GDP)	0.035 (0.439)	-0.010 (0.852)	0.021 (0.657)	-0.015 (0.772)
Stringency index	-0.019 (0.198)	-0.021 (0.177)	-0.019 (0.202)	-0.021 (0.181)
Income support index	0.008 (0.366)	0.010 (0.274)	0.008 (0.375)	0.010 (0.289)
Anti-self dealing index		-0.114 (0.667)		0.074 (0.775)
Regulatory quality		0.135 (0.291)		0.026 (0.884)
Daily fixed-effects dummy variables	Yes	Yes	Yes	Yes
Constant	-1.235 (0.368)	0.386 (0.813)	-0.141 (0.937)	1.038 (0.582)
Observations	1,706	1,644	1,706	1,644
R-squared	0.594	0.596	0.593	0.596

References

- Aggarwal, R., Goodell, J.W., 2014. National cultural dimensions in finance and accounting scholarship: An important gap in the literatures? *Journal of Behavioral and Experimental Finance* 1, 1–12.
- Aggarwal, R., Kearney, C., Lucey, B., 2012. Gravity and culture in foreign portfolio investment. *Journal of Banking & Finance* 36, 525–538.
- Al-Awadhi, A.M., Al-Saifi, K., Al-Awadhi, A., Alhamadi, S., 2020. Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns. *Journal of Behavioral and Experimental Finance*, 100326.
- Alfaro, L., Chari, A., Greenland, A.N., Schott, P.K., 2020. Aggregate and firm-level stock returns during pandemics, in real time. *National Bureau of Economic Research*.
- Ashraf, B.N., 2020a. Economic impact of government interventions during the COVID-19 pandemic: International evidence from financial markets. *Journal of Behavioral and Experimental Finance* 27, 100371.
- Ashraf, B.N., 2020b. Stock markets' reaction to COVID-19: cases or fatalities? *Research in International Business and Finance* 54, 101249.
- Ashraf, B.N., Arshad, S., 2017. Foreign bank subsidiaries' risk-taking behavior: Impact of home and host country national culture. *Research in International Business and Finance* 41, 318–335.
- Ashraf, B.N., Zheng, C., Arshad, S., 2016. Effects of national culture on bank risk-taking behavior. *Research in International Business and Finance* 37, 309–326.
- Baker, M., Wurgler, J., 2006. Investor sentiment and the cross-section of stock returns. *Journal of Finance* 61, 1645–1680.
- Baker, S., Bloom, N., Davis, S.J., Kost, K., Sammon, M., Viratyosin, T., 2020. The unprecedented stock market reaction to COVID-19. *Covid Economics: Vetted and Real-Time Papers* 1.
- Djankov, S., La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2008. The law and economics of self-dealing. *Journal of financial economics* 88, 430–465.
- Erdem, O., 2020. Freedom and stock market performance during Covid-19 outbreak. *Finance Research Letters*, 101671.
- Gerding, F., Martin, T., Nagler, F., 2020. The value of fiscal capacity in the face of a rare disaster. Available at SSRN 3572839.

- Goodell, J.W., 2020. COVID-19 and finance: Agendas for future research. *Finance Research Letters*, 101512.
- Gormsen, N.J., Kojien, R.S., 2020. Coronavirus: Impact on stock prices and growth expectations. University of Chicago. Becker Friedman Institute for Economics Working Paper.
- Hale, T., Webster, S., Petherick, A., Phillips, T., Kira, B., 2020. Oxford covid-19 government response tracker. Blavatnik School of Government, p. 25.
- Heritage_Foundation, 2020. Index of Economic Freedom, <https://www.heritage.org/index/about> data accessed on April 18, 2020.
- Hofstede, G., 1980. *Culture's consequences: International differences in work-related values*. Sage, Beverly Hills, CA.
- Hofstede, G., 2001. *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*. Sage Publications, Thousand Oaks, CA.
- Hofstede, G., Hofstede, G.J., Minkov, M., 2010. *Cultures and organizations: Software of the mind*. McGraw-Hill, New York, NY.
- House, R.J., Hanges, P.J., Javidan, M., Dorfman, P.W., Gupta, V., 2004. *Culture, leadership, and organizations*. Sage.
- Kwok, C.C., Tadesse, S., 2006. National culture and financial systems. *Journal of International Business Studies* 37, 227–247.
- Lucey, B.M., Zhang, Q., 2010. Does cultural distance matter in international stock market comovement? Evidence from emerging economies around the world. *Emerging Markets Review* 11, 62–78.
- Nadler, C., Breuer, W., 2019. Cultural Finance as a research field: an evaluative survey. *Journal of Business Economics* 89, 191–220.
- Ramelli, S., Wagner, A.F., 2020. Feverish stock price reactions to covid-19.
- Schmeling, M., 2009. Investor sentiment and stock returns: Some international evidence. *Journal of Empirical Finance* 16, 394–408.
- Wagner, A.F., 2020. What the stock market tells us about the post-COVID-19 world. *Nature Human Behaviour* 4, 440–440.
- World_Bank, 2020. COVID-19 Outbreak: Capital Markets Implications and Response. *Equitable Growth, Finance and Institutions: COVID-19 Notes, Finance Series*.
- Zhang, D., Hu, M., Ji, Q., 2020. Financial markets under the global pandemic of COVID-19. *Finance Research Letters*, 101528.