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Full length article

# Economic impact of government interventions during the COVID-19 pandemic: International evidence from financial markets

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## ABSTRACT

The outbreak of COVID-19 pandemic came as a rare, unprecedented event and governments around the globe scrambled with emergency actions including social distancing measures, public awareness programs, testing and quarantining policies, and income support packages. In this paper, we examine the expected economic impact of government actions by analyzing the effect of such actions on stock market returns. Using daily data from January 22 to April 17, 2020 from 77 countries, we find announcements of government social distancing measures have a direct negative effect on stock market returns due to their adverse effect on economic activity, while an indirect positive effect through the reduction in COVID-19 confirmed cases. Government announcements regarding public awareness programs, testing and quarantining policies, and income support packages largely result in positive market returns. Our findings have important policy implications, primarily by showing that government social distancing measures have both positive and negative economic impact.

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## 1. Introduction

The outbreak of highly contagious COVID-19 pandemic came as a surprise event with unprecedented uncertainty with respect to how deadly disease really is and whether and when can we get a vaccine. In response, governments across the world scrambled with emergency actions, such as lockdowns, travel restrictions, testing and quarantining, and economic packages. The main purpose of these actions was to ensure social distancing among people to contain the spread of the disease on the one hand, while to minimize the adverse economic impact on the other hand. However, these actions generated additional uncertainty regarding their effectiveness and impact. For instance, lockdowns, though could be effective in reducing new infections, increased the economic distancing as well thereby hurting the jobs and incomes of tens of millions of people. Despite the fact that long-term effect of these government actions yet has to be seen, in this paper, we examine their expected impact by analyzing the stock markets' reaction to these actions. Stock markets, which include the pool of sophisticated and opinionated investors, provide an incentivized survey of future expected outcomes. Wagner (2020) argues stock markets provide particularly useful information in fast evolving, complex situations.

Particularly, we examine stock markets' reaction to three types of government actions including social distancing measures, containment and health response, and income support packages. Social distancing measures include the closure of schools, workplaces, parks, public transport, among others. Containment and health response is mainly about government public awareness campaigns and testing and quarantining policy. Income support packages include the government financial assistance to households in the form of direct cash transfers or relief in debt or other payments for utilities.

We postulate that these government actions have both direct and indirect effects on stock market returns. For the direct effects, social distancing measures might have direct negative effect on stock market returns by adversely affecting economic activity. On the contrary, government containment and health response, and income support packages are likely to lead to positive market reaction by enhancing the investors' confidence and reducing the adverse economic effects due to the disease.

The indirect effect of these government actions channels through the reduction in the intensity of COVID-19 outbreaks. Comprehensive and strict government actions, such as stringent social distancing measures, aggressive testing and quarantining policy and generous government income support programs, might reduce the rate of new infections. Building on the recently emerging literature which reports that stock markets around the world have reacted to COVID-19 pandemic with strong negative returns (Al-Awadhi et al., 2020; Ashraf, 2020a; Baker et al., 2020;

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Ramelli and Wagner, 2020; Zhang et al., 2020), we argue that if strict government actions reduce the intensity of local outbreaks, then they weaken the negative market reaction to the growth in COVID-19 confirmed cases.

To empirically examine the above hypothesized relationships, we use a panel dataset of daily stock market returns, government responses and the growth in COVID-19 confirmed cases from 77 countries over the period January 22 to April 17, 2020. After controlling for country characteristics and systematic risk due to international factors, we find that social distancing measures have direct negative impact on stock returns, while an indirect positive impact by reducing the growth rate of new confirmed cases. Containment and health policies and income support packages have direct positive impact on stock returns, but do not affect stock returns indirectly through the reduction in growth in confirmed cases. Together, our results provide evidence that stock markets have priced in the impact of government actions. Results remain robust against alternative sample compositions and alternative estimation methods.

We offer at least two important contributions to the existing literature. First we add to the emerging literature which examines the impact of COVID-19 on financial sector outcomes. In this regard, recent literature surveys by Goodell (2020) and Yarovaya et al. (2020) suggest that COVID-19 pandemic might have important impact on the functioning of financial sector and is a promising research domain. Focusing on more specific issues, Corbet et al. (2020a) examined the impact of being named “corona” on stock returns and find that the companies with ‘corona’ word in their names experienced strong negative hourly returns and an exceptionally large increase in hourly volatility when COVID-19 pandemic was announced. Likewise, Sharif et al. (2020) find that the pandemic has a greater effect on the US geopolitical risk and economic uncertainty than on the US stock market. Debating the safe haven properties of different assets, Corbet et al. (2020b), Conlon and McGee (2020) and Conlon et al. (2020) conclude that crypto assets largely do not act as hedges, or safe havens, but perhaps rather as amplifiers of contagion during the bear market amid the pandemic. On the other hand, Goodell and Goutte (2020) analyze the Bitcoin reaction to daily COVID-19 world deaths and show that Bitcoin is a safe haven asset. Moreover, Sharif et al. (2020) find gold and soybean futures as having strong safe-haven role during the COVID-19 outbreak. In this regard, we examine how stock markets reacted to government actions aimed to control the pandemic. Besides, we also examine how government actions interact with local COVID-19 outbreaks to affect the stock market returns.

Second, we complement the recent studies which examine the impact of COVID-19 on financial markets (Al-Awadhi et al., 2020; Ali et al., 2020; Ashraf, 2020a; Baker et al., 2020; Haroon and Rizvi, 2020; Ramelli and Wagner, 2020; Schell et al., 2020; Zhang et al., 2020). For instance, focusing on stock market volatility, Baker et al. (2020) compared the reaction of US stock market to various infectious diseases and found that COVID-19 has inflicted the unprecedented volatility. Likewise, Zhang et al. (2020) examined the volatility of ten stock markets in the countries with most confirmed cases over the months of January and February, 2020, and found that volatility increased substantially in February due to COVID-19. Focusing on stock market returns, Alfaro et al. (2020) use data from the US and found that equity market value declined in response to pandemics such as COVID-19 and SARS. Likewise, Al-Awadhi et al. (2020) found overall share prices declined in China due to the expected adverse economic outcomes of COVID-19. Ashraf (2020a) examined data from 64 countries and found that overall stock markets reacted negatively to the COVID-19 outbreak however this reaction was only significant to the growth in number of confirmed cases but not to the growth

in number of deaths. We add to this literature by finding that stringent social distancing measures have significantly weakened the stock markets’ negative reaction to the growth in COVID-19 confirmed cases. In this regard, our study is comparable to Ashraf (2020b) who shows that higher national-level uncertainty avoidance significantly strengthens the negative stock markets’ reaction to the growth in COVID-19 confirmed cases.

The rest of the paper proceeds as follows: Section 2 introduces data collection procedure. Section 3 introduces the indexes which measure government response during the COVID-19 pandemic. Section 4 explains testable hypotheses. Section 5 is about empirical model. Section 6 reports empirical results. Final section concludes the study.

## 2. Data collection

For the purpose of this study, we mainly collected data from three main sources: Daily stock market returns data was collected from the [www.investing.com](http://www.investing.com) website. This data was available for around 80 countries. To maintain consistency, we choose only one major stock index from each sample country. Next, we downloaded the data of daily COVID-19 confirmed cases for each country from the John Hopkins University, Coronavirus Resource Centre (JHU-CRC) website. Lastly, we collected data of government response indexes from the OxCGRT website. We chose sample period from January 22 to April 17, 2020. We selected this sample period because both early COVID-19 confirmed cases and government responses in each country mainly occurred during this period. For example, Ramelli and Wagner (2020) argue that the most important period regarding market reaction to COVID-19 was from January 20 to March 20, 2020. Likewise, Hale et al. (2020a) show that average global government response curves flattened, and even started declining, from mid-April onward.

We appended three datasets together to get the main sample. We applied two filters to refine the main sample. First, we dropped countries with missing data of stock returns, COVID-19 confirmed cases or government response indexes. Second, we dropped daily observations with missing values of any of the required variables. Our refined sample consists of 2,750 daily observations from 77 countries over the period January 22 to April 17, 2020. Table 1 reports basic information about the sample distribution.

## 3. Measurement of government actions

We use Oxford COVID-19 Government Response Tracker (OxCGRT) database (Hale et al., 2020b) to quantify governments’ response to COVID-19 led crisis. OxCGRT has measured governments’ responses with three main indexes: stringency index, containment and health index and economic support index.

Stringency index records information on social distancing measures and is coded from 8 indicators including school closing, workplace closing, cancel public events, restrictions on gathering size, close public transport, stay at home requirements, restrictions on internal movement and restrictions on international travel.

Economic support index is constructed from 2 indicators including the government income support and debt/contract relief for households programs. This index represents government policies regarding income support to citizens amid crisis.

Containment and health index is coded from 3 indicators representing public awareness campaigns, testing policy and contact tracing. This index represents government emergency policies regarding health system such as the COVID-19 testing regime.

Each of the three indexes is simple additive score of the underlying indicators, and is rescaled to vary from 0 to 100.

**Table 1**  
Sample information.

Sr. no.	Country	The date of 1st COVID-19 confirm case	Stock index	Observations
1	Argentina	Mar 03, 2020	S&P Merval	26
2	Australia	Jan 26, 2020	S&P_ASX 200	47
3	Austria	Feb 25, 2020	ATX	35
4	Bahrain	Feb 24, 2020	Bahrain All Share	37
5	Bangladesh	Mar 08, 2020	DSE 30	12
6	Belgium	Feb 04, 2020	BEL 20	50
7	Brazil	Feb 26, 2020	Bovespa	34
8	Bulgaria	Mar 08, 2020	BSE SOFIX	26
9	Canada	Jan 26, 2020	S&P_TSX Composite	56
10	Chile	Mar 03, 2020	S&P CLX IPSA	30
11	China	Jan 22, 2020 <sup>a</sup>	Shanghai Composite	54
12	Colombia	Mar 06, 2020	COLCAP	26
13	Cote d'Ivoire	Mar 11, 2020	BRVM 10	23
14	Croatia	Feb 25, 2020	CROBEX	22
15	Cyprus	Mar 09, 2020	Main Market	23
16	Denmark	Feb 27, 2020	OMX Copenhagen 20	32
17	Ecuador	Mar 01, 2020	Guayaquil Select	31
18	Egypt	Feb 14, 2020	EGX 70 EWI	44
19	France	Jan 24, 2020	CAC 40	58
20	Germany	Jan 27, 2020	DAX	56
21	Greece	Feb 26, 2020	Athens General Composite	31
22	Hungary	Mar 04, 2020	Budapest SE	28
23	Iceland	Feb 28, 2020	ICEX Main	32
24	India	Jan 30, 2020	BSE Sensex 30	50
25	Indonesia	Mar 02, 2020	Jakarta SEC	31
26	Iraq	Feb 24, 2020	ISX Main 60	14
27	Ireland	Feb 29, 2020	ISEQ Overall	33
28	Israel	Feb 21, 2020	TA 35	32
29	Italy	Jan 31, 2020	FTSE MIB	52
30	Jamaica	Mar 11, 2020	JSE Market	20
31	Japan	Jan 22, 2020	Nikkei 225	58
32	Kazakhstan	Mar 13, 2020	KASE	22
33	Kenya	Mar 13, 2020	NSE 20	22
34	Korea, South	Jan 22, 2020	KOSP	58
35	Lebanon	Feb 21, 2020	BLOM Stock	34
36	Malaysia	Jan 25, 2020	FTSE KLCI	59
37	Mauritius	Mar 18, 2020	SEMDEX	20
38	Mexico	Feb 28, 2020	S&P_BMV IPC	31
39	Mongolia	Mar 10, 2020	MNE Top 20	27
40	Morocco	Mar 02, 2020	Moroccan All Shares	30
41	Namibia	Mar 14, 2020	FTSE NSX Overall	21
42	Netherlands	Feb 27, 2020	AEX	33
43	New Zealand	Feb 28, 2020	NZX 50	40
44	Nigeria	Feb 28, 2020	NSE 30	33
45	Norway	Feb 26, 2020	OSE Benchmark	33
46	Oman	Feb 24, 2020	MSM 30	36
47	Pakistan	Feb 26, 2020	Karachi 100	35
48	Peru	Mar 06, 2020	S&P Lima General	27
49	Philippines	Jan 30, 2020	PSEi Composite	51
50	Poland	Mar 04, 2020	WIG 30	29
51	Portugal	Mar 02, 2020	PSI 20	31
52	Qatar	Feb 29, 2020	QE General	34
53	Romania	Feb 26, 2020	BET	34
54	Russia	Jan 31, 2020	MOEX	53
55	Saudi Arabia	Mar 02, 2020	Tadawul All Share	32
56	Serbia	Mar 06, 2020	Belex 15	29
57	Singapore	Jan 23, 2020	FTSE Straits Times Singapore	60
58	Slovakia	Mar 06, 2020	SAX	27
59	Slovenia	Mar 05, 2020	Blue-Chip SBITOP	27
60	South Africa	Mar 05, 2020	TOP 40	28
61	Spain	Feb 01, 2020	IBEX 35	53
62	Sri Lanka	Jan 27, 2020	CSE All-Share	31
63	Sweden	Jan 31, 2020	OMX Stockholm 30	53
64	Switzerland	Feb 25, 2020	SMI	35
65	Taiwan	Jan 22, 2020	Weighted	54
66	Tanzania	Mar 16, 2020	All Share	19
67	Thailand	Jan 22, 2020	SET Index	59
68	Tunisia	Mar 04, 2020	Tunindex	28
69	Turkey	Mar 11, 2020	BIST 100	26
70	Uganda	Mar 21, 2020	All Share	13
71	Ukraine	Mar 03, 2020	PFTS	21
72	United Arab Emirates	Jan 29, 2020	ADX General	54

(continued on next page)

**Table 1** (continued).

Sr. no.	Country	The date of 1st COVID-19 confirm case	Stock index	Observations
73	United Kingdom	Jan 31, 2020	FTSE 100	53
74	United States	Jan 22, 2020	S & P 500	59
75	Venezuela	Mar 14, 2020	Bursatil	20
76	Vietnam	Jan 23, 2020	VN	56
77	Zambia	Mar 18, 2020	LSE All Share	17
Total				2750

This table reports the sample countries, as well as the date of 1st COVID-19 confirm case, the main stock index and total daily data observations from each country.

<sup>a</sup>China had cases well before Jan 22, 2020.

The indexes are for comparative purposes and should not be interpreted as a rating of the appropriateness or effectiveness of a country's response (Hale et al., 2020a). Appendix reports detailed definitions of these government response indexes.

#### 4. Testable hypothesis

In this section, we draw testable hypotheses regarding the direct and indirect impact of announcements of government social distancing measures, containment and health policies and economic support programs on stock market returns.

Social distancing saves lives on the one hand, while imposes large costs on society due to the reduced economic activity on the other hand. Therefore, government actions, such as lockdowns and travel restrictions, targeted to ensure social distancing are expected to have both direct and indirect effects on stock returns. For the direct effect, such policies have adverse economic impact by shutting down places of work such as schools, offices, and factories. For instance, Sauvagnat et al. (2020) estimate that a 10% increase in state-level labor restrictions in the US led to a 3% drop in employment and a 1.87% drop in firms' market value in the month of April 2020 only. When investors price these adverse valuation effects, the stringent government social distancing measures lead to decline in stock market returns. Based on this discussion, we write our first hypothesis in the following form:

**H1a:** The announcements of government social distancing measures lead to decline in stock market returns.

Despite the direct negative effect on economic activity, social distancing might also have positive economic impact by reducing the risk of mortalities (Greenstone and Nigam, 2020; Thunström et al., 2020). In this regard, Greenstone and Nigam (2020) estimate that moderate social distancing in the USA beginning from late March 2020 would save 1.7 million lives by October 1 in the USA. The major chunk of lives saved is due to avoided overwhelming of hospital intensive care units. Using the estimates of the United States Government's value of a statistical life, they project \$8 trillion economic benefits of social distancing through reduction in mortalities. Likewise, Thunström et al. (2020) estimate a net benefit of about \$5.2 trillion of social distancing in the USA. The people in countries where government implemented stringent social distancing policies are more likely to practice social distancing (Hussain, 2020) and hence have lower chances to get infected and consequently die from the virus. Thus, the benefits of social distancing mainly channeled through the reduction in new infections.

A number of recent studies show that stock markets reacted to the growth in COVID-19 confirmed cases with negative returns (Al-Awadhi et al., 2020; Ashraf, 2020a). We postulate if social distancing has positive impact by reducing new infections, then stringent government social distancing measures would weaken the negative stock market reaction to the growth in confirmed cases. Our specific hypothesis is as follows:

**H1b:** The announcements of stringent government social distancing measures are likely to weaken the stock markets' negative reaction to the growth in COVID-19 confirmed cases.

Likewise, stock market reaction to government measures regarding the containment and healthcare system might be positive. For instance, government aggressive information campaign provides awareness about the benefits of staying at home, sanitize common places and washing hands regularly. Moreover, testing and contact tracing helps to identify infected and suspected cases. In the early phases of the pandemic, countries such as South Korea and Japan have achieved enormous success in controlling the local outbreaks through extensive testing and contact tracing. Better healthcare policies are likely to lead to positive market reaction by boosting investors' confidence and trust in government to control the pandemic.

**H2a:** The announcements of government containment and healthcare policies lead to increase in stock market returns.

Further, better containment and health policies are likely to produce benefits in terms of lower new infections and mortality rates. Lower mortality rate in turn provides enormous economic benefits in terms of more saved lives (Greenstone and Nigam, 2020; Thunström et al., 2020). Therefore, we hypothesis if public awareness campaigns and testing and contact tracing have positive impact by reducing new infections, then announcements of containment and health policies would weaken the negative stock market reaction to the growth in confirmed cases.

**H2b:** The announcement of government containment and health policies are likely to weaken the stock markets' negative reaction to the growth in COVID-19 confirmed cases.

Finally, stock market reaction to government economic support programs is likely to be positive. Economic support programs, to some extent, can counter adverse impact of the social distancing measures on incomes and employment. Direct cash transfers help households to buy essential goods while staying under lockdowns. Therefore, investors might react positively to such actions and our specific hypothesis is as under.

**H3a:** The announcements of government economic support programs lead to increase stock market returns.

Income support programs might also affect stock returns by reducing the infection rate due to higher compliance with social distancing measures. Recent studies, such as Lou et al. (2020) and Wright et al. (2020) find that compliance with stay-at-home orders varies significantly with income, where lower-income groups are less likely to follow the orders and more likely to get exposed to the virus. Since income support is largely provided to poor segments of the society, more generous income support programs can lead to reduction in infection rates by motivating lower income individuals to stay at home.

**H3b:** The announcements of government income support packages are likely to weaken the stock markets' negative reaction to the growth in COVID-19 confirmed cases.



## 5. Methodology

Following Ashraf (2020a), we specify following pooled panel ordinary least squares regression model to examine the direct impact of government actions on stock market returns.

$$Y_{c,t} = \alpha_c + \beta_1(\Delta \text{Government response}_{c,t}) + \beta_2(\text{COVID} - 19_{c,t-1}) + \sum_{C=1}^{C-1} \beta_C C_C + \sum_{t=1}^{T-1} \epsilon_t D_t + \epsilon_{c,t} \quad (1)$$

Here,  $Y$  is the dependent variable and measures stock market returns in county  $c$  on day  $t$ .  $\alpha_c$  is a constant term. Specifically, daily stock market return equals  $(\text{Index value}_t - \text{Index value}_{t-1} / \text{Index value}_{t-1})$ . Government response is represented with the daily change in three government response indexes from OxCGRT dataset (Hale et al., 2020b). These variables include stringency index, containment and health index and economic support index. Following Ashraf (2020a) who found that stock markets' reaction was significant to COVID-19 cases but not to fatalities, we measure COVID-19 as the daily growth in COVID-19 confirmed cases.

In a cross-country setting, investors' reaction to similar events might vary due to specific institutional or cultural contexts of countries (Ashraf, 2020b). Since our study sample is very short, most of the country-level factors remain fixed. Therefore, rather than to include individual country-level control variables, we add a matrix of country fixed-effects dummy variables. These dummy variables effectively control for all factors which remain fixed over the sample period but differ across sample countries. Stock markets also react to international events such as oil prices or major international events with strong spill-over effects across borders. To control for this systematic risk due to international factors, we include daily fixed-effects dummy variables,  $D_t$ , in the model.  $\epsilon_{c,t}$  is an error term. We use heteroskedastic-robust standard errors to estimate  $p$ -values in regressions.

We modify Eq. (1) as follows to examine the indirect impact of government actions on stock market returns through the channel of reduction in new infections.

$$Y_{c,t} = \alpha_c + \beta_1(\Delta \text{Government response}_{c,t}) + \beta_2(\text{COVID} - 19_{c,t-1}) + \beta_3((\Delta \text{Government response}_{c,t}) \times (\text{COVID} - 19_{c,t-1})) + \sum_{C=1}^{C-1} \beta_C C_C + \sum_{t=1}^{T-1} \epsilon_t D_t + \epsilon_{c,t} \quad (2)$$

The interaction term,  $(\Delta \text{Government response}_{c,t}) \times (\text{COVID} - 19_{c,t-1})$ , is the main variable of interest where the estimated values of coefficient,  $\beta_3$ , show whether the stock market reaction to the growth in COVID-19 confirmed cases depends on government actions. We use interaction terms for each of the three government response indexes with growth in confirmed cases. All other variables are same as in Eq. (1).

## 6. Empirical analysis

This section reports empirical results. Table 2 reports summary statistics for main variables. The stock market returns variable has a mean value of  $-0.00$  with a standard deviation of  $0.03$ . Zero mean value confirms the random walk property of stock market returns. The  $0.17$  mean value of the growth in confirmed COVID-19 cases variable indicates on average COVID-19 cases observed a 17 percent daily increase. The minimum and maximum values of government response indexes show that governments have responded with significant changes in policies.

Table 3 reports main empirical results. Model 1 is the baseline specification. The growth in confirmed cases variable enters negative and significant. This result confirms the findings of previous

studies, such as Al-Awadhi et al. (2020), Alfaro et al. (2020) and Ashraf (2020a) that stock markets reacted to COVID-19 outbreaks with strong negative returns, and validates our model for further analysis. We include government response indexes in Model 2. The stringency index enters negative and significant showing that stock markets react with negative returns to government actions regarding increase in social distancing measures. This result indicates that corporate valuations on average decline due to the adverse effect of social distancing on economic activity and supports our hypothesis H1a. Both containment and health, and economic support indexes enter positive showing that overall stock markets reacted to these government actions with positive returns. However, the result of economic support index is not statistically significant. One possible reason is that economic support index, which we use, measures the income and debt relief support to households but not to businesses. Therefore, stock market reaction to these actions, though positive, is not very strong. On the contrary, stock markets might have reacted more strongly to financial support to businesses which, unfortunately, economic support index does not measure. Future studies might focus on this area.

Next, we examine how government actions interact with the growth in COVID-19 confirmed cases to affect stock market returns. As shown in Model 3, the interaction term, Growth in confirmed cases  $\times$  Stringency index, enters positive and significant suggesting that the negative impact of growth in confirmed cases on stock market returns weakens in countries with more stringent social distancing measures. This result confirms that markets take social distancing positively because of its effectiveness in reducing the number of COVID-19 confirmed cases. Other two interaction terms, Growth in confirmed cases  $\times$  Containment and health index and Growth in confirmed cases  $\times$  Economic support index, are not statistically significant suggesting that the impact of government actions related to healthcare and income support is not channeled through the reduction in confirmed cases. Together, these results suggest investors expect that government social distancing measures are the most effective mechanism to contain the disease while public awareness and testing and quarantining policies are less so.

Following Ashraf et al. (2020), we use graphical approach to explain the moderating effect of government actions on the relationship between stock returns and growth in confirmed cases with interaction terms. For doing so, we graph relationship between stock returns and growth in confirmed cases at mean and  $\pm$  one standard deviation of mean value of all three government response indexes, one-by-one. Graphs 1, 2 and 3 in Fig. 1 are drawn from Model 3 of Table 3.

The overall downward sloped lines in these graphs show that stock market 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 with variation in government actions. This variation is the strongest in Graph 1 for social distancing measures where the slope of the lower line (with embedded circles) turns to be positive as compared to the negative slope of the upper line (with embedded squares). This suggests when government implements stringent social distancing measures, the stock markets' negative reaction to the growth in confirmed cases not only weakens but becomes positive. In Graphs 2 and 3, slopes of upper and lower lines change only slightly and remain negative confirming that government actions regarding containment and health, and economic support do not significantly moderate the negative association between stock returns and growth in confirmed cases.

We perform several robustness tests to further confirm the above results. In this regard, first we replace country fixed-effects

**Table 2**  
Summary statistics.

Variable	Observations	Mean	Standard deviation	Minimum value	Maximum value
Stock market returns	2750	-0.00	0.03	-0.11	0.08
Growth in confirmed cases	2750	0.19	0.62	0.00	22.00
Stringency index	2750	1.39	4.92	-13.00	44.00
Containment and health index	2750	1.24	4.15	-11.00	38.00
Economic support index	2750	1.09	6.89	-12.00	100.00

This table reports the summary statistics of main variables. Stock market returns is measured as the daily change in major stock index of a country. Growth in confirmed cases is measured as the daily growth in COVID-19 confirmed cases in a country. Stringency index represents the announcements of government social distancing measures, such as closure of schools, work places and public places, and restrictions on internal and international travel. Containment and health index represents the announcements of government policies regarding public awareness campaigns, testing policy and contact tracing. Economic support index represents the government announcements of income support and debt/contract relief for households.

**Table 3**  
Impact of government actions amid COVID-19 on stock market returns.

Variables	Stock market returns		
	Model (1)	Model (2)	Model (3)
Growth in confirmed cases	-0.003** (0.036)	-0.003** (0.034)	-0.003* (0.073)
Stringency index		-0.001** (0.012)	-0.001*** (0.004)
Containment and health index		0.001*** (0.005)	0.001*** (0.003)
Economic support index		0.000 (0.282)	0.000 (0.233)
Growth in confirmed cases × Stringency index			0.001* (0.070)
Growth in confirmed cases × Containment and health index			-0.000 (0.250)
Growth in confirmed cases × Economic support index			-0.000 (0.530)
Country fixed-effects dummies	Yes	Yes	Yes
Daily fixed-effects dummies	Yes	Yes	Yes
Constant	-0.002 (0.865)	-0.002 (0.815)	-0.002 (0.845)
Observations	2,750	2,750	2,750
R-squared	0.478	0.479	0.480

This table reports the results regarding the impact of government actions to control COVID-19 pandemic on stock market returns. Stock market returns is dependent variable in all models and is measured as the daily change in major stock index of a country. Growth in confirmed cases is measured as the daily growth in COVID-19 confirmed cases in a country. Stringency index represents the announcements regarding government social distancing measures, such as closure of schools, work places and public places, and restrictions on internal and international travel. Containment and health index represents the announcements regarding government policies such as public awareness campaigns, testing policy and contact tracing. Economic support index represents the announcements regarding government income support and debt/contract relief for households programs. 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% levels.

\*\*Represent statistical significance at 5% levels.

\*Represent statistical significance at 10% levels.

dummies with country-level macroeconomic and institutional control variables. Specifically, following Ashraf (2020a), we include log (GDP), investment freedom, democratic accountability and uncertainty avoidance. Definitions of these variables are given in Appendix. Log (GDP) variable controls for the differences in economic development of countries. Investment freedom index measures the easiness with which foreign investors can invest in a country and controls for the presence of foreign competition in local financial market. Democratic accountability index controls for the cross-country differences in political institutions. Likewise, uncertainty avoidance index controls for the differences in uncertainty aversion of stock market investors from different countries. As shown in Table 4, the main results largely are similar to those in Table 3 even after replacing country fixed-effects dummies with specific country-level control variables.

Second, we use panel random-effects model as an alternative estimation method and re-estimate all specifications of Table 3. In unreported results,<sup>1</sup> we observe findings largely remain similar as in Table 3.

## 7. Conclusion

In this paper, we examine the expected economic impact of government actions, such as social distancing measures, public awareness programs, testing and quarantining policies, and economic support packages, during the COVID-19 pandemic by analyzing the effect of such actions on stock market returns. For empirical analysis, we use the daily data of stock market returns, growth in COVID-19 confirmed cases and announcements

<sup>1</sup> Results are available from authors on request.

**Table 4**  
Impact of government actions amid COVID-19 on stock market returns.

Variables	Stock market returns		
	Model (1)	Model (2)	Model (3)
Growth in confirmed cases	−0.003** (0.012)	−0.003*** (0.009)	−0.003** (0.032)
Stringency index		−0.001*** (0.007)	−0.001** (0.011)
Containment and health index		0.001*** (0.002)	0.001*** (0.004)
Economic support index		0.000 (0.235)	0.000 (0.172)
Growth in confirmed cases × Stringency index			0.001* (0.081)
Growth in confirmed cases × Containment and health index			−0.000 (0.399)
Growth in confirmed cases × Economic support index			−0.000 (0.315)
Log (GDP)	0.000 (0.406)	0.000 (0.345)	0.000 (0.344)
Investment freedom	−0.000 (0.648)	−0.000 (0.667)	−0.000 (0.680)
Democratic accountability	0.000 (0.823)	0.000 (0.817)	0.000 (0.823)
Uncertainty avoidance	−0.000 (0.671)	−0.000 (0.611)	−0.000 (0.629)
Daily fixed-effects dummies	Yes	Yes	Yes
Constant	−0.010 (0.331)	−0.011 (0.284)	−0.011 (0.282)
Observations	2,372	2,372	2,372
R-squared	0.526	0.527	0.527

This table reports the results regarding the impact of government actions to control COVID-19 pandemic on stock market returns. Stock market returns is dependent variable in all models and is measured as the daily change in major stock index of a country. Growth in confirmed cases is measured as the daily growth in COVID-19 confirmed cases in a country. Stringency index represents the announcements regarding government social distancing measures, such as closure of schools, work places and public places, and restrictions on internal and international travel. Containment and health index represents the announcements regarding government policies such as public awareness campaigns, testing policy and contact tracing. Economic support index represents the announcements regarding government income support and debt/contract relief for households programs. Log (GDP) is measured as the log of gross domestic product of a country. Investment freedom represents financial market liberalization where higher values represent more freedom for foreign investors to invest in local financial markets and vice versa. Democratic accountability index measures political institutions where higher values represent democratic political institutions while lower values stand for autocratic institutions. Uncertainty avoidance measures cultural uncertainty aversion where higher values show the individuals are more uncertainty averse and vice versa. 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% levels.

\*\*Represent statistical significance at 5% levels.

\*Represent statistical significance at 10% levels.

regarding government policies from 77 countries over the period January 22 to April 17, 2020.

We find the announcements regarding the implementation of social distancing measures by governments have dual, a direct negative and an indirect positive, effect on stock market returns. Specifically, the announcements of social distancing measures result in negative stock market returns due to their expected adverse impact on economic activity. While these announcements lead to positive market returns through the channel of reduction in COVID-19 confirmed cases. Government announcements regarding public awareness programs, testing and quarantining policies, and income support packages largely result in positive market returns.

Our findings have important implications. Though some studies such as Heyden and Heyden (2020), Shanaev et al. (2020) and Zaremba et al. (2020) show government social distancing measures are counterproductive, however we show that such measures also have indirect beneficial economic impact through the channel of reduction in the intensity of COVID-19 outbreaks. Therefore, it is difficult to predict their net impact on economic outcomes and more research needs to be done with the availability of further data to better understand the economic impact of such government measures. Our findings to some extent are

aligned with Correia et al. (2020) who find that stringent non-pharmaceutical interventions used across the U.S. cities during the 1918 Flu Pandemic led to better economic outcomes in the medium run. As the frequency of pandemics, including contagious diseases, has increased over recent decades (Ross et al., 2015), a consensus regarding the net economic impact of government social distancing measures can help in designing better government response in the future.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

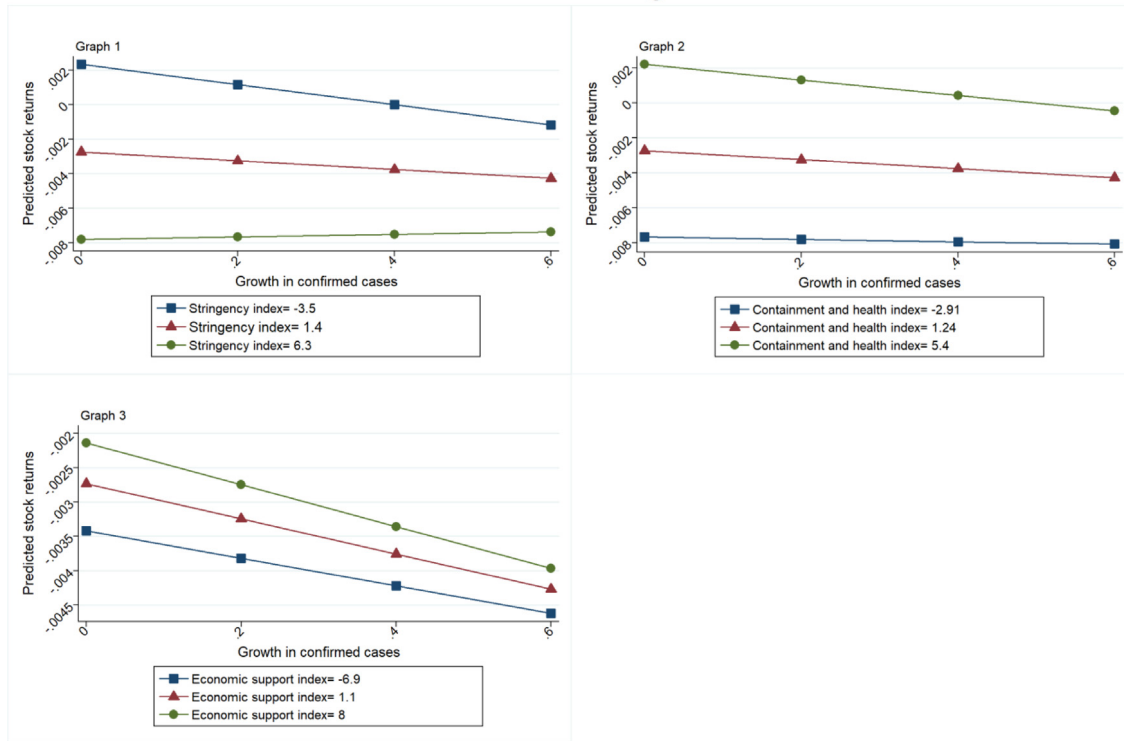
#### Appendix

See Table A.1.



# Indirect Economic Impact of Government Actions

## Predictive margins



**Fig. 1.** The indirect impact of government actions on stock returns through the channel of reduction in COVID-19 confirmed cases.

**Table A.1**

Variable definitions.

Variable	Definition	Data source
<i>Dependent variables</i>		
Stock market returns	Stock market returns are measured as the daily change in major stock index of a country. Specifically, it equals $(\text{Index value}_t - \text{Index value}_{t-1}) / \text{Index value}_{t-1}$ .	<a href="http://www.investing.com">www.investing.com</a>
<i>Main independent variable</i>		
Growth in confirmed cases	The daily growth rate of COVID-19 confirmed cases for a country calculated as $((\text{Cases}_t - \text{Cases}_{t-1}) / \text{Cases}_{t-1})$ .	Author calculation with data from John Hopkins University, Coronavirus Resource Centre (JHU-CRC) website
Stringency index	Stringency index records information on social distancing policies and is coded from 8 indicators including school closing, workplace closing, cancel public events, restrictions on gathering size, close public transport, stay at home requirements, restrictions on internal movement and restrictions on international travel. The index is simple additive score of the underlying indicators, and is rescaled to vary from 0 to 100. We measure daily change of this variable as $(\text{Stringency index}_t - \text{Stringency index}_{t-1})$ . For brevity, we name it as Stringency index.	Author calculation with data from Oxford COVID-19 Government Response Tracker (OxCGRT) database (Hale et al., 2020b)
Containment and health index	Containment and health index is coded from 3 indicators representing public awareness campaigns, testing policy and contact tracing. The index varies from 0 to 100. We measure daily change of this variable as $(\text{Containment and health index}_t - \text{Containment and health index}_{t-1})$ . For brevity, we name it as Containment and health index.	
Economic support index	Economic support index is constructed from 2 indicators including the government income support and debt/contract relief for households programs. The index varies from 0 to 100. We measure daily change of this variable as $(\text{Economic support index}_t - \text{Economic support index}_{t-1})$ . For brevity, we name it as Economic support index.	

(continued on next page)

Table A.1 (continued).

Variable	Definition	Data source
<i>Additional control variables</i>		
Log (GDP)	Equals the natural logarithm of annual gross domestic product (GDP) of each country.	World Development Indicators database, World Bank
Democratic accountability	Democratic Accountability index from International Country Risk Guide (ICRG) database. Democratic Accountability index represents political institutions where higher values show higher democratic accountability and vice versa.	ICRG database
Investment freedom	Investment freedom index measures the level of freedom to invest in financial markets. Specifically, it is calculated with the extent of movement (both inward and outward) of capital, capital controls on the repatriation of profits, restrictions to invest in specific sectors, the way to treat foreign investment and the availability of transparent foreign investment code. The index ranges from 0 to 100 where higher values represent higher investment freedom and vice versa.	Heritage Foundation (2020)
Uncertainty avoidance	Uncertainty avoidance index from the framework of national culture by Hofstede. Index values range from 0 to 100 where higher values represent higher national-level uncertainty avoidance and vice versa.	Hofstede et al. (2010)

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