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What caused global stock market meltdown during the COVID pandemic–Lockdown stringency or investor panic?

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ABSTRACT

This paper isolates the different effects of COVID-19 on the stock market returns and identifies the channels through which each of the effects influences the returns. Using a sample of twelve countries with most liquid stock markets, we find that the panic caused by the pandemic affects the stock return negatively through the updation of market risk premium channel. The stringency of the lockdown has a two-way effect on the stock market returns, whereas it affects the return negatively through the updation of growth forecasts, it also affects the return positively through the updation of market risk premium.

1. Introduction

The coronavirus disease 2019 (COVID-19) was declared a global pandemic by the WHO on 11th March 2020. With the severity and contagious effects of the novel virus unknown to almost everyone and with the growing number of cases in many countries across the globe, the panic level in individuals increased manifold. The panic was visibly apparent with news coming in of supermarkets being stocked out of toilet-paper in many countries throughout the world[1]. In parallel, amidst the rising cases of infections and deaths, many of the governments resorted to announcing lockdowns to various degrees. These included closing schools, workplaces, travel bans, or even complete curfews.

In this paper, we attempt to analyze the channels through which the COVID-19 has influenced the global stock market return in the five months before June 2020. The MSCI All-Country World Equity index had dropped from 565.24 (December 2019 end) to 509.47 (May 2020 end). Theoretically, there are two primary channels through which stock returns can get negatively affected: - (a) Investors update their growth expectations about the future to a lower value (growth channel), or (b) investors start demanding higher market risk premium (MRP) for investing in equity markets (MRP channel). Our contribution here is to study how the panic around COVID-19 and the lockdown effects impact the growth and the MRP channel, and in the process, provide a better understanding of the impact of COVID-19 on global financial markets.

The higher the stringency of the lockdown process of the country, the greater the difficulty in conducting regular business operations. Therefore, from a rational investor perspective, the lockdown stringency should affect the stock market of the country negatively, and the likely channel of the relationship is investors updating their expected growth. For measuring stringency of the lockdown process, we use the stringency index for each country provided by ourworldindata.org[2]. The measure is a simple additive score of nine

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[1] https://edition.cnn.com/2020/03/20/business/panic-buying-how-stores-restock-coronavirus/index.html

[2] Our World in Data is a collaboration between researchers at University of Oxford and Global Change Data Lab.

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Table 1
Break-up of market return in return attributable to growth and MRP updation for March 2020.

Country	Index	Total market return	Return attributed to growth updation	Return attributed to MRP updation
Australia	ASX200	-21.18%	-6.54%	-14.64%
Canada	TSX Composite	-17.74%	-13.02%	-4.71%
China	Shanghai Composite	-4.51%	-2.35%	-2.16%
Germany	DAX	-16.44%	-18.26%	1.82%
Hong Kong	Hang Seng	-9.67%	-0.04%	-9.63%
India	NIFTY 50	-23.25%	-0.01%	-23.24%
Japan	Nikkei 225	-10.53%	-6.39%	-4.14%
South Korea	KOSPI	-11.69%	-20.00%	8.30%
Switzerland	SMI	-5.28%	-10.87%	5.59%
Taiwan	TWSE	-14.03%	-4.63%	-9.40%
UK	FTSE 100	-13.81%	-20.85%	7.05%
US	S&P 500	-12.51%	-5.48%	-7.03%

This table gives the break-up of stock market return into return attributable to growth updation and return attributable to MRP updation for March 2020. Return attributable to growth updation is calculated by first estimating an index value using analysts forecasts for index EPS for the next three years and the previous month's implied market risk premium and then calculating the return based on this estimated index value and actual index value for the previous month. The residual return (actual return – return attributable to growth updation) is considered as the return attributable to MRP updation.

indicators measured on an ordinal scale, rescaled to vary from 0 to 100. The nine indicators include school closure, public gathering closure, public transport closure, international travel ban, etc.

The effect of human panic on stock markets has been documented primarily for terrorist attacks (Chen and Siems, 2004). The panic due to such attacks has been mostly related to stock market declines; however, the declines have been often temporary (Brounen and Derwall, 2010), indicating that the explanation is often associated with sentiment rather than rationality. Indeed, after controlling for the stringency of the lockdown process, panic from COVID-19 should not lead the rational investor to drive down stock prices. Still, if there is any effect of increased panic from COVID-19 towards the stock market returns, the likely channel could be that investors have become more risk-averse and therefore demand more MRP. To measure the induced panic due to the coronavirus crisis, we use the panic index for each country created by Ravenpack. The Coronavirus Panic Index measures the level of news chatter that refers to panic or hysteria and Coronavirus. The value x of the index in a country indicates that x percent of all news in that country is about panic and COVID-19.

Our sample includes data from twelve countries with the highest trading volumes as per the latest data available from the World Federation of Exchanges. We consider stock market data for these twelve countries for six months, beginning December 2019 and ending May 2020. We empirically find that the stringency of lockdown (panic effect) negatively affects (does not affect) the stock return due to investors updating their growth estimates, in line with our expectation. We also find that the panic effect negatively affects the stock return through the MRP channel, as we expected. Surprisingly, however, once the panic effect has been controlled for, the lockdown stringency effect positively impacts the stock market return through the MRP channel. We link this unexpected finding to the human psychology of feeling safer about surroundings, the more stringent the lockdown process is. Nevertheless, we fall short of trying to fully explain this unexpected finding as that is beyond the scope of the current paper and call for future research on behavioral finance to explore this issue in detail.

Our paper contributes to the small but growing literature on COVID-19. Many of the studies have focused on a single country. Takahashi and Kazuo (2020), Al-Awadhi et al. (2020), and Ramelli and Wagner (2020), respectively, analyze the impacts of COVID-19 on Japanese, Chinese, and American firms. Albulescu (2020) affirms that news reports from outside China have more impact on the VIX index than news from China. Erdem (2020) finds that the adverse effects of COVID-19 on stock markets are less in freer countries. Zhang et al. (2020) use data from ten most COVID-19 affected countries and show that the stock market risks have increased due to the pandemic. Our work adds to the very small sample of works on COVID-19, which draws on financial data from multiple countries. The paper focuses on twelve countries with the highest trading volume and complements the existing work by analyzing the effects and the channels through which COVID-19 affects the global stock markets.

2. Data and methodology

As mentioned above, we have used data from Ravenpack and ourworldindata.org for obtaining the values for the panic index and the stringency index, respectively. We also used Bloomberg for extracting the month-end stock price data for the benchmark indices[3] of the twelve countries for the period from December 2019 to May 2020.

A vital part of the analysis of this paper is the isolation of stock market return attributable to updated growth numbers from total stock returns. To isolate these returns, we use the concept that value of a stock is the present value of its future expected cash-flows. Thus, the only two sources of value are the future expected cash-flows (growth) and the discount rates used to discount these cash-

[3] Bloomberg gives earnings per share (EPS) and book-value-per-share (BVPS) data for indices using a weighted average of constituent EPS and BVPS values.

Table 2
Panic index for Hong Kong and the US.

Month	US	Hong Kong
31-Jan-20	1.38	13.34
28-Feb-20	2.72	6.83
31-Mar-20	6.13	2.15
30-Apr-20	3.91	2.17
29-May-20	3.15	2.59

This table shows the values of the Ravenpack Coronavirus panic index for Hong Kong and the US from January end 2020 to May end 2020. The panic index measures the level of news chatter that refers to panic or hysteria and Coronavirus. A value of 7 indicates that 7 percent of news in the country talks about panic and COVID-19.

Table 3
Stringency index for India and the US.

Month	India	US
31-Jan-20	10.19	0
28-Feb-20	10.19	5.56
31-Mar-20	100	72.69
30-Apr-20	96.3	72.69
29-May-20	79.17	72.69

This table shows the values of the stringency index as reported by ourworldindata.org for India and the US from January end 2020 to May end 2020. The stringency index measures the severity of government lockdown measures in combating the spread of COVID-19. A higher value of index implies a higher level of stringency and hence a greater lockdown.

flows (MRP). We use the Bloomberg EPS and BVPS data for the last five years along with the analyst estimates of expected EPS data for the next three years. We use these to estimate an implied market risk premium at the end of December 2019 (Soenen and Johnson, 2008; Damodaran, 2008). Then we repeat the process for the end of every month till May 2020. We then revalue each of the country indices using the analyst estimates of index EPS and the previous month's implied risk premium at the end of every month from January 2020 to May 2020. Since the analyst estimates of EPS for the indices change frequently, this gives us the expected value of an index when growth numbers are updated but market risk premium is unchanged from the previous month. The percentage change in this expected value of the index from the actual value of the index at the end of the previous month gives us the part of stock returns attributable to growth updation. The residual returns (actual stock market return – returns due to growth updation) is the part of return attributable to MRP updation.

For exposition purposes, Table 1 shows the details of this break-up for March 2020 for the twelve countries.

Once the partitioning of the total return into components due to growth updation and MRP updation is done, we next focus on the details of the panic effect and stringency of the lockdown effect.

The panic effect, which we represent through the Ravenpack Coronavirus panic index of a country, is expected to capture the level of fear from COVID-19 that is running through the country at a given point of time. For exposition purposes, we provide the value of this index for two countries Hong Kong and the US in Table 2. For Hong Kong, we see much higher numbers in January, in line with the peak of COVID-19 cases observed in that country. For the US, we find the panic index has the highest value in March, again in line with the explosion of the number of cases in that month.

The stringency of the lockdown, represented in our paper through the stringency index obtained from ourworldindata.org, is expected to capture the severity of government actions to control the spread of the deadly virus. The higher the value of the index, the greater the departure of the country from business as usual. Again, for exposition purposes, we provide the value of this index for two countries, India and the US, in Table 3. For India, the index has a maximum value of 100 in March, confirming the complete lockdown the country was subject to at that point. For the US, the highest value is 72.69, and it is consistent through March, April, and May, reflecting the similar levels of lockdown process throughout the three months.

As discussed earlier in the paper, we attempt to identify the channels through which the two effects of COVID-19 affect the stock return. As hypothesized before, we expect that the panic effect affects market returns negatively through the MRP updation channel, and the stringency of the lockdown effect affects market returns negatively through the growth forecast updation channel. To test the joint hypothesis, we regress both the returns, due to growth updation and due to MRP updation, on the panic effect and the stringency of the lockdown effect.

Formally, we empirically estimate the following regression equations with country fixed effects:

$$R_{ij}(G) = \alpha_G + \beta_{PG} * P_{ij} + \beta_{SG} * S_{ij} + \zeta_{ij}(G) \quad (1)$$

Table 4
Returns attributable to growth and MRP updation on panic and stringency indices.

	1 Market Return attributable to growth updation	2 Market return attributable to MRP updation
Stringency index	-0.0021***	0.0024***
	(0.000)	(0.000)
Panic index	0.0041	-0.0125**
	(0.247)	(0.019)
Number of observations	60	60
R-square	0.3622	0.2916
Country fixed effects	Y	Y
Stringency index stdd. dev.	30.616	
Panic index stdd. dev.	3.491	

This table shows the results of the regression of market returns attributable to growth updation and MRP updation on the stringency index and panic index for the months January 2020 to May 2020. Both the regressions have country fixed effects.
Values in parenthesis indicate *p*-values.
*,** and *** indicate significance at 10%, 5% and 1% levels respectively.

Table 5
Returns attributable to growth and MRP updation on COVID-growth and stringency index.

	1 Market Return attributable to growth updation	2 Market return attributable to MRP updation
Stringency index	-0.0012***	0.0009**
	(0.000)	(0.020)
COVID growth	0.0095	-0.0283*
	(0.375)	(0.082)
Number of observations	60	60
R-square	0.2229	0.0961
Country fixed effects	Y	Y
Stringency index stdd. dev.	30.616	
Panic index stdd. dev.	3.491	

This table shows the results of the regression of market returns attributable to growth updation and MRP updation on stringency index and COVID growth. Both the regressions have country fixed effects.
Values in parenthesis indicate *p*-values.
*,** and *** indicate significance at 10%, 5% and 1% levels respectively.

$$R_{ij}(M) = \alpha_M + \beta_{PM} * P_{ij} + \beta_{SM} * S_{ij} + \zeta_{ij}(M) \quad (2)$$

where i stands for countries and j stands for months, G stands for "Growth updation," and M stands for "MRP updation" and "P" stands for panic effects, and "S" stands for stringency in lockdown effect.

3. Results

Table 4 provides the estimates of the regression of Eqs. (1) and (2) and forms the basis of the main results of the paper. We find that β_{PG}, the coefficient of Panic effect on return due to change of growth estimates, is statistically insignificant from zero. From the same regression, we also find that β_{SG}, the coefficient of the lockdown stringency effect is negative and significant at 1% level of significance. Thus, we find that while panic does not affect the returns through growth updation channel, the greater the stringency of the lockdown, the greater its negative effect on returns through the same channel. This is perfectly in line with rational investor expectation. Mere panic from a pandemic does not change rational investor expectation about future growth in stocks; however, the difficulty of conducting business, represented by the lockdown stringency, affects the growth prospect of stocks negatively and affects the returns through that channel. We find that one standard deviation increase in the stringency index for a country causes the market returns due to the growth updation channel to fall by 6.54 percentage points.

The estimates from Eq. (2) provide a different picture. Here we find that β_{PM} is negative and significant at the 5% level, suggesting that the panic effect impacts the stock return negatively through the MRP channel. Thus, the greater the level of panic in the country from COVID-19, the greater MRP investors demand from investing in equity markets and hence greater the fall in market returns, keeping all else constant. This essentially means investors start becoming more risk-averse once panic level from COVID-19 increases. This result is in line with earlier literature, which finds that sentiment and stock market have a relationship. We find that one standard deviation change in the panic index for a country causes the market returns through the MRP channel to fall by 4.35 percentage points. The coefficient β_{SM} provides a surprising result. A priori, we expected that once the panic level has been controlled for, the lockdown severity will not have a significant impact on returns through the MRP channel. However, we find that β_{SM} to be positive and significant. This suggests the more stringent the lockdown process is, the investors feel safer, in general, about investing in equity markets, and that is reflected in their lower MRP demand. Further enlightenment about this phenomenon is beyond the scope of this paper, and

Table 6
Returns attributable to growth and MRP updation on stringency index and residuals of panic.

	1 Market Return attributable to growth updation	2 Market return attributable to MRP updation
Stringency index	-0.0023***	0.0024***
	(0.000)	(0.000)
Panic residuals	0.0038	-0.0122**
	(0.238)	(0.018)
Number of observations	60	60
R-square	0.5529	0.4038
Country fixed effects	Y	Y

This table shows the results of the regression of market returns attributable to growth updation and MRP updation on stringency index and residuals of panic (from regressing panic on stringency). Both the regressions have country fixed effects.
Values in parenthesis indicate *p*-values.
*,** and *** indicate significance at 10%, 5% and 1% levels respectively.

Table 7
Returns attributable to growth and MRP updation on panic and stringency indices.

	1 Market Return attributable to growth updation	2 Market return attributable to MRP updation
Stringency index	-0.0020***	0.0024***
	(0.000)	(0.000)
Panic index	0.0027	-0.0116***
	(0.278)	(0.001)
Number of observations	96	96
R-square	0.2759	0.2791
Country fixed effects	Y	Y
Stringency index stdd. dev.	26.440	
Panic index stdd. dev.	2.993	

This table shows the results of the regression of market returns attributable to growth updation and MRP updation on the stringency index and panic index for the months January 2020 to August 2020. Both the regressions have country fixed effects.
Values in parenthesis indicate *p*-values.
*,** and *** indicate significance at 10%, 5% and 1% levels respectively.

we call on future research on behavioral finance to provide additional explanation. Overall, the stringency level has two opposing effects on the total stock returns, a negative effect through the growth updation channel, and a positive effect through the MRP updation channel.

4. Robustness tests

4.1. Using COVID growth as the proxy for panic

We replace the Ravenpack panic index of a country by the COVID-19 growth percentage to directly relate the COVID-19 growth as a representative estimate of the level of panic due to COVID-19. Table 5 provides estimates of the regression. All the results remain qualitatively similar; however, β_{PM} is now negative and significant at the 10% level.

4.2. Addressing possible interdependence of stringency and panic

To confirm that our main results are not driven by any empirical dependency between our two regressors, we use the residual values of panic (after regressing panic on stringency) instead of raw panic index, in the main regressions. Residual values of panic are uncorrelated with stringency index, by definition. The results (provided in Table 6) remain qualitatively similar to Table 4.

4.3. Results for January–August 2020 period

To check whether our results are robust even after the initial COVID-19 outbreak period, we include data for 3 further months – June to August, 2020. We estimate Eqs. (1) and (2) with 8 months of data and we find that the results remain comparable (Table 7).

4.4. Results including control variables

And finally, in our base model we include three control variables which are known to affect stock market returns – the country-month values for Stock index volatility, foreign exchange rate and 10-year government bond rates. We find that the explanatory

Table 8
Returns attributable to growth and MRP updation on stringency index, panic and control variables.

	1 Market Return attributable to growth updation	2 Market return attributable to MRP updation
Stringency index	-0.0014***	0.0028***
	(0.005)	(0.001)
Panic index	0.0029	-0.0086**
	(0.362)	(0.049)
Stock index volatility	-2.5486***	-2.192*
	(0.006)	(0.076)
Government bond returns	0.0286	-0.0377
	(0.569)	(0.585)
Exchange rate against USD	1.3193**	-2.424***
	(0.025)	(0.003)
Number of observations	60	60
R-square	0.6355	0.6115
Country fixed effects	Y	Y

This table shows the results of the regression of market returns attributable to growth updation and MRP updation on stringency index, panic and control variables. Both the regressions have country fixed effects.
Values in parenthesis indicate *p*-values.
*,** and *** indicate significance at 10%, 5% and 1% levels respectively.

power of our variables of interest stay qualitatively similar even after including the controls (Table 8).

5. Conclusion

In this paper, we aim to provide interesting insights and advance the growing literature on the negative impact of COVID-19 on stock market returns. The contribution of our multi-country study is to recognize the different effects originating from the COVID-19 pandemic, which can impact the stock markets and to identify the channels through which these effects influence the stock returns. We find that panic created from the pandemic affects the overall returns negatively by increasing the market risk premium demanded by investors. The stringency of the lockdown has a mixed effect on the overall returns; while on the one hand, it affects the overall return negatively by impacting the growth estimates but on the other hand, it impacts the return positively by making investors feel safe and as a consequence, demanding a lower equity risk premium.

CRediT authorship contribution statement

Shobhit Aggarwal: Conceptualization, Methodology, Formal analysis. **Samarpan Nawn:** Writing - original draft, Writing - review & editing. **Amish Dugar:** Data curation.

References

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. J. Behav. Exp. Finance 27, 100326.
Albulescu, C. (2020). Coronavirus and financial volatility: 40 days of fasting and fear. arXiv preprint arXiv:2003.04005.
Brounen, D., Derwall, J., 2010. The impact of terrorist attacks on international stock markets. Eur. Financ. Manage. 16 (4), 585–598.
Chen, A.H., Siems, T.F., 2004. The effects of terrorism on global capital markets. Eur. J. Polit. Econ. 20 (2), 349–366.
Damodaran, A., 2008. Equity risk premiums (ERP): determinants, estimation and implications. Estim.Implic.
Erdem, O., 2020. Freedom and stock market performance during COVID-19 outbreak. Finance Res. Lett. 36, 101671.
Ramelli, S. & Wagner, A.F. (2020). Feverish stock price reactions to COVID-19.
Soenen, L., Johnson, R., 2008. The equity market risk premium and the valuation of overseas investments. J. Appl. Corp. Finance 20 (2), 113–121.
Takahashi, H., Yamada, K., 2020. When Japanese stock market meets COVID-19: impact of ownership, trading, ESG, and liquidity channels. Trading ESG Liq. Channels.
Zhang, D., Hu, M., Ji, Q., 2020. Financial markets under the global pandemic of COVID-19. Finance Res. Lett. 36, 101528.