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Death and Contagious Infectious Diseases: Impact of the COVID-19 Virus on Stock Market Returns

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Abstract

This study investigates whether contagious infectious diseases affect stock market outcomes. As a natural experiment, we use panel data regression analysis to measure the effect of the COVID-19 virus, which is a contagious infectious disease, on the Chinese stock market. The findings indicate that both the daily growth in total confirmed cases and in total cases of death caused by COVID-19 have significant negative effects on stock returns across all companies.

Keywords: Stock returns; COVID-19

JEL Classification: G10, G14, G15, C22

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1. Introduction

Stock market returns respond to major events. Previous studies have identified several major events that have affected such returns, for example, disasters (Kowalewski & Śpiewanowski, 2020), sports (Buhagiar et al., 2018), news (Li, 2018), and environmental (Guo et al., 2020) and political events (Bash & Alsaifi, 2019; Shanaev & Ghimire, 2019). Stock market returns may also respond to epidemic diseases, for example, Severe Acute Respiratory Syndrome (SARS) outbreak (Chen et al., 2007; Chen et al., 2009), and Ebola Virus Disease (EVD) outbreak (Ichev & Marinč, 2018). However, there is scant research on the extent to which epidemic diseases interact with stock returns.

This study examines the effect of a more recent epidemic disease on stock market outcomes, specifically the effect of the COVID-19 contagious infectious disease on the Chinese stock market. COVID-19 is part of a large family of viruses (Coronaviruses) that may cause illness ranging from the common cold to more severe diseases (Yang et al., 2020).

Figure 1 summarizes the major events relating to the COVID-19 outbreak. According to Sohrabi et al. (2020), on 31 December 2019, there were several cases of pneumonia presenting with flu like symptoms in Wuhan. It is believed that the first cases are linked to a seafood market in Wuhan, the capital city of Hubei province in China (Sohrabi et al. 2020; Yang et al., 2020). The first death from the virus was reported on 11 January 2020 (Pharmaceutical Technology, 2020). In the same month, the Chinese authorities rolled out containment measures with extreme quarantine, including closing off large cities, borders, and restraining people to their homes to limit the spread of COVID-19 (Yang et al., 2020). By early March 2020, there were signs that the containment measures adopted in China were having the desired effect with consistent falls in the numbers of new cases (John Hopkins University, 2020) and most of the new temporary hospitals in Hubei had closed (Pharmaceutical Technology, 2020).

Dec. 31	• Chinese government informs WHO of occurrences of viral flu-like symptoms in multiple patients in Wuhan, Hubei province
Jan. 11	• First death from novel coronavirus reported in Wuhan, China
Jan. 13	• First death not on Chinese soil is reported in Thailand
Feb. 13	• Daily new confirmed cases in China spike by 15,152
Mar. 7	• Number of new cases per day in China falls below 100

Figure 1: Main Events Relating to COVID-19

Major events may significantly affect stock market returns (Zach, 2003). The COVID-19 outbreak has affected the investment and business environment in China. The principal novelty of the present study is the examination of the effect of contagious infectious diseases, specifically the COVID-19 virus, on stock market returns. As stated, the outbreak started on 31 December 2019, and since then, the number of infected cases has been published on a daily basis. To investigate the effect of this epidemic on stock returns, we employ a panel regression approach using two measurements: (1) daily growth in total confirmed cases and (2) daily growth in total deaths caused by COVID-19.

Our results provide evidence of a significant negative effect of both measurements on stock returns across all companies included in the Hang Seng Index and Shanghai Stock Exchange Composite Index over the period of 10 January to 16 March 2020. Our further tests suggest that some sectors performed better than others during the outbreak of the COVID-19, specifically, information technology and medicine manufacturing sectors. We also find that B-shares which are designed for foreign investors face a significant higher negative effect on the returns in comparison with A-shares which are traded only by Chinese citizens. Finally, high market capitalization stocks face a significant higher negative effect on the returns in comparison with low market capitalization stocks. The implications of our study are important for stock market main players to understand and predict the behaviour of stock market returns during epidemic diseases.

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The rest of this paper is organized as follows: The next section provides the research methodology. Section 3 presents the data and empirical tests. Section 4 concludes the paper.

2. Methodology

Due to the fact that the peak of the event is not the start date and and that this lasts for several days, we do not follow classical event study methodologies. Baltagi (2008) and Hsiao (2014) suggest that panel data regression reduces estimation bias and multicollinearity, controls for individual heterogeneity, and identifies the time-varying relationship between dependent and independent variables. We therefore apply panel testing to examine the relative performances of stocks in relation to COVID-19, while controlling for firm-specific characteristics. We estimate stock returns as:

$$DR_{i,t} = \alpha_0 + \alpha_1 C19_{i,t-1} + \beta X_{i,t-1} + \varepsilon_{i,t}, \tag{1}$$

where $DR_{i,t}$ is the return of stock i at day t, regressed on the lagged previous daily values of firm return predictors, which are $C19_{i,t-1}$, is either (1) daily growth in total confirmed cases or (2) daily growth in total cases of death caused by COVID-19. $X_{i,t-1}$ is a vector of firm-specific characteristics and $\varepsilon_{i,t}$ is the error term. $X_{i,t-1}$ includes the natural logarithm of daily market capitalization (LMCAP) and daily market-to-book ratio (MTB).

3. Data and Empirical Tests

3.1. Data

We use the data of companies included in the Hang Seng Index and Shanghai Stock Exchange Composite Index over the period from January 10 to March 16, 2020. Data were obtained from Bloomberg and include stock prices, market capitalization, and market-to-book ratio for the aforementioned period (1,579 stocks and 78,252 observations). We also obtained the number of daily active confirmed cases and daily cases of death from COVID-19 in China for the same period from Worldometer, which are available on daily basis.

Figure 2 shows the cumulative average daily returns for the stocks included in our study, Figure 3 shows daily active confirmed cases of COVID-19, and Figure 4 shows daily confirmed deaths caused by COVID-19. The figures suggest that cumulative returns are negatively related to both the daily active confirmed cases and the daily confirmed deaths

caused by COVID-19, and that market returns start to increase as the growth of both daily active cases and confirmed deaths starts to decline.
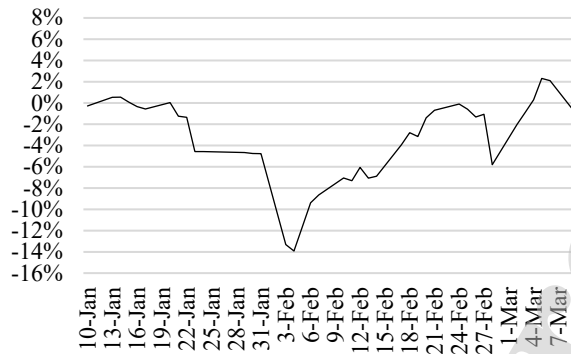
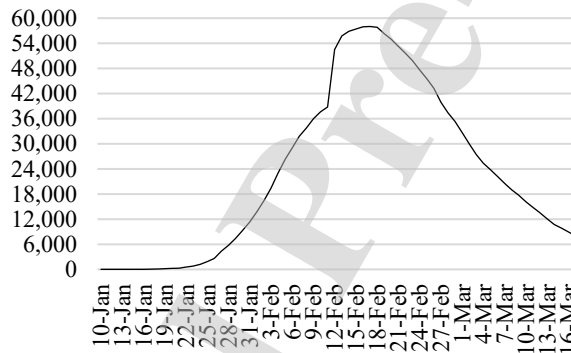**Figure 2: Cumulative Average Daily Returns**

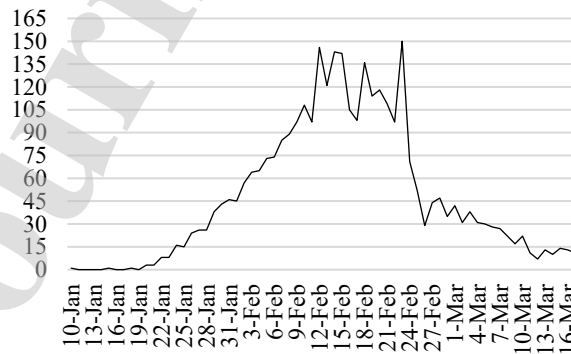**Figure 3: Daily Active Confirmed COVID-19 Cases**

Figure 4: Daily Confirmed Cases of Death from COVID-19

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Table 1 presents the summary statistics of the data included in our study. It can be seen that the maximum daily stock during the period is 44% and the minimum is -17%. The highest growth in daily total confirmed cases is 53.7% and the highest growth in daily total cases of death caused by COVID-19 is 100%.

Table 2 shows the correlation matrix of the data. It can be seen that daily stock returns are negatively correlated with both the daily growth in total confirmed cases and the daily growth in total cases of death caused by COVID-19.

3.2. Empirical Tests

Table 3 reports the results of our panel data tests, in which we analyzed all the listed stocks on the Chinese stock market during the during the outbreak of the COVID-19. The results suggest that stock returns are significantly negatively related to both the daily growth in total confirmed cases and the daily growth in total cases of death caused by COVID-19.

We found similar results when we repeated our tests with firm fixed-effects and cluster robust estimators by firm (results are available upon request). We also found similar results when we repeated our tests for the Hang Seng Index and Shanghai Stock Exchange Composite Index separately over the period (results are available upon request).

4. Further Analysis

4.1. Sector Analysis

During such epidemic disease we would naturally expect different sectors to be differentially affected. For the stocks of Shanghai Stock Exchange Composite Index, we consider the following sectors: finance, properties, conglomerates, industrials, public utility, and commerce, based on Industry Classification of Listed Companies (1999) released by the China Securities Regulatory Commission (CSRC). We use panel data tests with sector dummy variables that take the value one if stock (i) is listed in that respective sector, and zero otherwise. Our results suggest an insignificant difference in returns between sectors following this classification (results are available upon request).

However, previous studies suggest that a minor specific sector may get effected in a different way in such epidemic disease, such as, hotels, pharmaceutical, and biotechnological sectors

(Chen et al., 2007; Chen et al., 2009; Ichev & Marinč, 2018). In line with these studies we repeat our tests considering ten out of eighty-two sectors included in CSRC Industry Classification of Listed Companies (2001). Specifically, information technology, medicine manufacturing, health and nursing services, food processing, beverages, food manufacturing, air transportation, water transportation, highway transportation, and hotels.

Table 4 reports the results of our panel data tests with minor specific sector dummy variables. The results suggest that stock returns of information technology and medicine manufacturing sectors performed significantly better than the market, while stock returns of beverages, food manufacturing, air transportation, water transportation, and highway transportation sectors performed significantly worse than the market during the COVID-19 outbreak.

4.2. Foreign Investors Analysis

To understand the impact of the COVID-19 outbreak on local and international shares we repeated our tests by differentiating between A-shares and B-shares of Shanghai Stock Exchange Composite Index. A-shares are traded in Chinese Yuan and due to the Chinese government regulations, they are traded only by Chinese citizens, while B-shares are designed for foreign investors and traded in US dollars (Su & Bangassa, 2011).

Table 5 reports the results of the panel data tests during the COVID-19 outbreak including B-share dummy variable that is equal to one if stock (i) is a B-share, and zero otherwise. The results suggest that B-shares experienced significantly more negative effect than A-shares. In another words, stocks owned by foreign investors faced stronger drop in prices in comparison to the stocks owned by local investors.

4.3. Market Capitalization Analysis

Finally, we analyse the effect of the COVID-19 outbreak on stock market returns of large and small market capitalization stocks. We rank all stocks based on their market capitalization and use the 50th percentile as a breakpoint between large and small stocks. We use a dummy variable that take the value one if stock (i) is in large 50th percentile, and zero otherwise. The results of the panel data tests including market capitalization dummy variable suggest that large market capitalization stocks experience significantly more negative effect on returns than small market capitalization stocks (results are available upon request).

5. Conclusion

Analysing all the stocks of both Hang Seng Index and Shanghai Stock Exchange Composite Index during the COVID-19 contagious infectious disease outbreak in China, we find that this epidemic disease interacts negatively with stock market returns. Specifically, stock returns are significantly negatively related to both the daily growth in total confirmed cases and the daily growth in total cases of death caused by COVID-19.

Appendix 1: Tables

Table 1: Summary Statistics

	DR	DGTCC	DGTCC	LMCAP	MTB
Mean	0.001	0.193	0.184	8.997	7.189
Median	0.000	0.141	0.095	8.691	2.012
SD	0.031	0.164	0.263	1.416	77.011
Max	0.440	0.537	1.000	15.197	23,93.772
Min	-0.172	0.012	0.000	4.241	0.337
Skewness	0.101	0.768	2.013	1.051	25.782
Kurtosis	8.994	2.331	6.182	4.674	724.635

Note. DR is the daily stock return, DGTCC is the daily growth in total confirmed cases, DGTDC is the daily growth in total cases of death, LMCAP is the natural logarithm of daily firm market capitalization, and MTB is the daily market-to-book ratio.

Table 2: Correlation Matrix

	DR	DGTCC	DGTDC	LMCAP	MTB
DR	1				
DGTCC	-0.097	1			
DGTDC	-0.0672	0.6872	1		
LMCAP	0.0074	-0.0022	0.003	1	
PTB	0.0009	-0.0004	0	-0.055	1

Note. DR is the daily stock return, DGTCC is the daily growth in total confirmed cases, DGTDC is the daily growth in total cases of death, LMCAP is the natural logarithm of daily firm market capitalization, and MTB is the daily market-to-book ratio.

Table 3: Panel Regression

Panel A: Daily Growth in Total Confirmed Cases			
	(1)	(2)	(3)
α_0	0.0054***	0.0089***	0.0089***
	(0.0002)	(0.0007)	(0.0007)
DGTCC	-0.0293***	-0.0292***	-0.0292***
	(0.0007)	(0.0007)	(0.0007)
LMCAP		-0.0004***	-0.0004***
		(0.0001)	(0.0001)
MTB			-0.0003
			(0.0000)
Panel B: Daily Growth in Total Death Cases			
	(1)	(2)	(3)
α_0	0.0029***	0.0063***	0.0063***
	(0.0002)	(0.0007)	(0.0007)
DGTCC	-0.0175***	-0.0175***	-0.0175***
	(0.0004)	(0.0004)	(0.0004)
LMCAP		-0.0004***	-0.0004***
		(0.0001)	(0.0001)
MTB			-0.0003

Note. This table reports the coefficients of the panel regressions results for companies included in the Hang Seng Index and Shanghai Stock Exchange Composite Index over the period 10 January to 16 March 2020. Panel A reports the coefficients of the panel regressions for the ratio of daily growth in total confirmed cases. Panel B reports the coefficients of the panel regressions for the ratio of daily growth in total cases of death. The dependent variable is $DR_{i,t}$, which is the return of stock i at day t. α_0 is the intercept, DGTCC is the daily growth in total confirmed cases, DGTDC is the daily growth in total cases of death. LMCAP is the natural logarithm of daily firm market capitalization, and MTB is the daily market-to-book ratio. The results of MTB are multiplied by 1,000. The robust standard errors are in parentheses; *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Panel Regression with Specific Sectors Dummy Variable

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
α_0	0.0043***	0.0042***	0.0043***	0.0043***	0.0043***	0.0043***	0.0042***	0.0043***	0.0044***	0.0043***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
LMCAP	-0.0004***	-0.0004***	-0.0004***	-0.0004***	-0.0004***	-0.0004***	-0.0004***	-0.0004***	-0.0004***	-0.0004***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
MTB	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Information Technology	0.0019***									
	(0.0006)									
Medicine Manufacturing		0.0020***								
		(0.0006)								
Health & Nursing Services			0.0027							
			(0.0026)							
Food Processing				0.0006						
				(0.0014)						
Beverages					-0.0026***					
					(0.0007)					
Food Manufacturing						0.0007				
						(0.0009)				
Air Transportation							-0.0023*			
							(0.0012)			
Water Transportation								-0.0025***		
								(0.0007)		
Highway Transportation									-0.0017**	
									(0.0007)	
Hotels										-0.0029
										(0.0020)

Note. This table reports the coefficients of the panel regressions results for companies included in the Shanghai Stock Exchange Composite Index over the period 10 January to 16 March 2020. The dependent variable is $DR_{i,t}$, which is the return of stock i at day t. α_0 is the intercept, LMCAP is the natural logarithm of daily firm market capitalization, MTB is the daily market-to-book ratio. Information Technology, Medicine Manufacturing, Health and Nursing services, Food Processing, Beverages, Food Manufacturing, Air Transportation, Water Transportation, Highway Transportation, Hotels are sector dummy variables that take the value one if the stock is listed in in that respective sector, and zero otherwise. The results of MTB are multiplied by 1,000. The robust standard errors are in parentheses; *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

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Table 5: Panel Regression Based on Shares Class

	(1)	(2)	(3)
α_0	0.0006***	0.0053***	0.0053***
	(0.0001)	(0.0006)	(0.0006)
B-Shares	-0.0018***	-0.0029***	-0.0029***
	(0.0005)	(0.0005)	(0.0005)
LMCAP		-0.0005***	-0.0005***
		(0.0001)	(0.0001)
MTB			-0.0001
			(0.0000)

Note. This table reports the coefficients of the panel regressions results for companies included in the Shanghai Stock Exchange Composite Index over the period 10 January to 16 March 2020, considering class A and B shares. The dependent variable is $DR_{i,t}$, which is the return of stock i at day t. α_0 is the intercept, B-Shares is a dummy variable equals to one if the stock is a B-share, and zero otherwise, LMCAP is the natural logarithm of daily firm market capitalization, and MTB is the daily market-to-book ratio. The results of MTB are multiplied by 1,000. The robust standard errors are in parentheses; *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

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