

Do stock markets love misery? Evidence from the COVID-19

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A B S T R A C T

This study examines the impact of the change in the Barro Misery Index (BMI) and the novel coronavirus (COVID-19) cases and deaths on the stock markets' returns and volatility. Based on a sample of 76 different countries, we find that an increase in BMI adversely affects the stock returns and increases stock volatility. We also find that an increase in BMI coupled with an increase in percentage cases of COVID-19 adversely affect stock returns and increases volatility. We find that the impacts of BMI on stock returns and volatility are driven by real GDP changes, unemployment rate, and long-term interest rate instead of inflation rates, especially for the developed countries. Our findings are consistent with Barro (1999), which indicates that the BMI represents a better measure relative to the original misery index in predicting the economic outcome, especially during the COVID-19 pandemic. We also find that the impacts of BMI components on stock returns and volatility for the developed countries are different from the emerging markets.

1. Introduction

Global financial markets are experiencing an unprecedented shock due to the novel coronavirus outbreak, also known as COVID-19. Initially identified in Wuhan city in China, COVID-19 has spread swiftly across the world and to more than 210 countries. Existing literature has identified that unlike the previous pandemic diseases such as bird flu, SARS, swine flu, Ebola, and MERS, COVID-19 has brought an unprecedented effect on stock markets' returns and volatility (Baker et al., 2020). Barro et al. (2020) compare the impact of COVID-19 with the Spanish Flu from 1918 to 1920 across 48 countries and conclude that the effect of COVID-19 on the stock markets is unique compared to other pandemic outbreaks given the massive potential losses in lives and economic activity. Fernandez (2020) examines the impact of COVID-19 on the GDPs across 30 different countries and finds that the average GDP growths in these countries are expected to decline by 2.8%.

Recent studies have examined the impact of COVID-19 on the equity market returns and volatility. Goodell and Huynh (2020) find that fifteen U.S. industries returns react negatively to COVID-19. (Zhang et al., 2020) examine the impact of COVID-19 on stock market volatility across 11 developed countries and China and find that the volatility has increased substantially from February to March 2020. Similarly, Onali (2020) finds that COVID-19 significantly affects the U.S. equity market toward the end of February 2020. However, most of these studies only examine the impacts of cases and mortality rates from COVID-19 on the stock markets (Ashraf,

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2020; Azimli, 2020; Ramelli& Wagner, 2020; Shehzad, Xiaoxing&Kazouz, 2020) instead of examining the impact of the change in the real economic wellbeing during COVID-19 outbreaks on the stock markets. Goodell (2020) emphasizes that studying changes in real economic activities during COVID-19 outbreaks is crucial. He shows that COVID-19 is "creating economic destruction on an unprecedented scale" (pg. 3).

As the impacts of COVID-19 on real economic activities for 2020 become available, our study attempts to examine how the stock markets and investors across the globe respond to this information. Consistent with existing literature, which indicates that the Barro Misery Index (BMI) provides a better measure of economic wellbeing (Barro, 1999; Ekren, Alp & Yağmur, 2017; Welsh, 2007), our study extends the literature by examining the impact of Barro Misery Index (BMI) on stock market returns and volatility during the COVID-19 outbreaks across 76 different countries. Further, we extend extant literature on emerging markets (Topcu&Gulai, 2020) by examining BMI's differing effect on emerging and developed markets.

2. Data and sample statistics

We collected the daily numbers of new and cumulative cases and deaths from the World Health Organization (World Health Organization (WHO) 2020) Coronavirus Disease (COVID-19) Dashboard (<https://covid19.who.int/>) from January 14, 2020, until September 30, 2020. After various research forms across different countries, we found 78 countries out of 216 countries and territories listed in the November 10, 2020, WHO Coronavirus Disease (COVID-19) Dashboard with stock indices. We downloaded the daily index and 30-day volatility data for each country's major stock index (e.g., S&P500 for the USA) from the Bloomberg terminal. We retrieved the Iran stock market index (TEDPIX) from the Tehran Stock Exchange website (<https://tse.ir/en/archive.html>) and manually calculated the daily returns and 30-day volatility. Two countries (i.e., Bangladesh and Kuwait) have missing information on stock indices and/or volatility and therefore were excluded from our sample.

To construct the Barro Misery Index (BMI), we downloaded and manually collected the quarterly data of real gross domestic product (GDP) growth, long-term interest rate, unemployment rate, and inflation rate from all of these countries for the fourth quarter of 2019 and the first, second and third quarters of 2020 from the Bloomberg terminal, the OECD website (<https://data.oecd.org/interest/long-term-interest-rates.htm>), the International Monetary Fund (IMF) website (<https://data.imf.org/regular.aspx?key=61545867>), trading economics (www.tradingeconomics.com), country economy (www.countryeconomy.com), statista (www.statista.com) and other online sources. We calculate each country's BMI level in each quarter based on Barro (1999) by adding up the unemployment rate, inflation rate, and long-term interest rate and subtracting them from the real GDP growth. After merging all the data and deleting missing observations, our final sample comprises 11,237 total observations across 76 countries. All 76 countries and their major indices are listed in the Appendix.

To account for variations in sizes of cases and deaths across different countries, we calculate the percentage of daily increase in the percentage of new cases (%CASE) as the daily new cases divided by the cumulative cases to measure the virus transmission speed. We calculate the percentage of new deaths (%DEATH) as the daily new deaths divided by the cumulative cases as our daily mortality rate measure. We calculate the percentage of daily stock index returns (RET) as a measure of stock returns. Consistent with the mixture of distribution hypothesis (Clark, 1973; Darolles, Fol&Mero, 2017; Epps & Epps, 1976), we calculate the daily percentage change in the 30-day volatility as our measures of stock markets volatility (CHGVOL). Barro (1999) indicates that in examining the BMI, we must "look at the change over the entire course" (pg. 22) instead of the levels. Therefore, we calculate the quarterly change in BMI (CHGBMI) by taking the level of BMI in the first quarter of 2020 minus the level of BMI in the fourth quarter of 2019, the level of BMI in the second quarter of 2020 minus the level of BMI in the first quarter of 2020 and the level of BMI in the third quarter of 2020 minus the level of BMI in the second quarter of 2020.

Table 1 presents the summary statistics. The average daily returns during our sample period are 0.027% and the average daily percentage change in volatility is 0.091%. The daily averages in the percentages of new cases and new deaths due to COVID-19 during our sample period are 5.38% and 0.21%, respectively. The average quarterly change in BMI (CHGBMI) during three quarters of 2020 is

Table 1.
Panel A. Sample statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
RET	11,237	0.00027	0.027	-0.169	0.185
CHGVOL	11,237	0.00091	0.091	-2.231	2.113
%CASE	11,237	0.0538	0.201	0	0.964
%DEATH	11,237	0.0021	0.009	0	0.5
CHGBMI	11,237	1.202	13.314	-36	43.9
CHGDP	11,237	-0.473	10.748	-33.4	34.5
CHGINT	11,237	-0.097	1.587	-7.25	10.5
CHGUNE	11,237	0.765	1.863	-5.22	10.5
CHGINF	11,237	0.061	4.067	-8	23.7

Note: RET represents daily stock indices returns (in decimal). CHGVOL represents the percentage change in 30-day volatility (in decimal). %CASE is percentage of daily new cases over cumulative cases (in decimal). %DEATH is percentage of daily new deaths over cumulative cases (in decimal). CHGBMI a quarterly change in Barro Misery Index or BMI (Barro, 1999) (%). CHGDP a quarterly change in real GDP growth (%). CHGINT is a quarterly change in the long-term interest rate (%). CHGUNE is a quarterly change in the unemployment rate (%). CHGINF is a quarterly change in inflation rate (%).

1.202, which indicates that, on average, the misery index has increased during 2020. On average, the real GDPs have shrunk 0.473% and the long-term interest rates have fallen by 0.097%, while the unemployment rate and inflation rate have increased by 0.765% and 0.061%, respectively.

3. Regression results

We conduct multivariate regressions to examine the impact of the quarterly change in BMI (CHGBMI) and daily percentage changes in cases (%CASE) and deaths (%DEATH) due to COVID-19 on daily return (RET) and volatility (CHGVOL). We are also interested in examining the impact of the interactions between CHGBMI and %CASE and %DEATH on RET and CHGVOL. We include the one-day lag of RET and CHGVOL to control for autocorrelation of daily stock returns and volatility. We also check the autocorrelation problem using the Woolridge test for autocorrelation in panel data and the results are insignificant. We also include eight monthly dummy variables with September as the excluded dummy to control the time trend. We use White (MacKinnon & White, 1985) robust standard errors, cluster the standard errors based on country; we include country dummy variables to control for the heteroscedasticity problem and the differences in stock market characteristics across different countries.

3.1. Impact of BMI

Table 2 shows that a 1% increase in misery index (CHGBMI) is associated with 0.017% lower returns and 0.0362% higher volatility of 0.0362% when we control for %CASE. We find that the %CASE and %DEATH do not significantly affect stock market returns and volatility. Instead, we find that CHGBMI and %CASE interaction variable are also related with 0.002% lower returns and 2.651% higher volatility. The results are similar when we control for %DEATH. Our results imply that increases in COVID-19 cases

Table 2.
Multivariate regression analysis.

VARIABLES	RET	CHGVOL	RET	CHGVOL
RET(t-1)	-0.01492 (0.033)		-0.01454 (0.033)	
CHGVOL(t-1)		0.06647** (0.031)		0.06885** (0.031)
%CASE	-0.000003 (0.000)	0.01999 (0.097)		
CHGBMI	-0.00017*** (0.000)	0.00362*** (0.001)	-0.00232*** (0.000)	0.00418*** (0.001)
%CASE x CHGBMI	-0.00002** (0.000)	0.02651* (0.014)		
%DEATH			-0.07475 (0.061)	-0.73016 (1.848)
%DEATH x CHGBMI			-0.00565 (0.005)	0.23456 (0.243)
JAN	-0.00480*** (0.001)	0.11099** (0.043)	-0.00447*** (0.001)	0.14215*** (0.040)
FEB	-0.00390*** (0.001)	0.17326*** (0.036)	-0.00367*** (0.001)	0.18889*** (0.035)
MAR	-0.00684*** (0.001)	0.81465*** (0.063)	-0.00680*** (0.001)	0.85914*** (0.064)
APR	0.00548*** (0.001)	0.15660*** (0.032)	0.00555*** (0.001)	0.15771*** (0.032)
MAY	0.00328*** (0.001)	0.08456*** (0.031)	0.00331*** (0.001)	0.08009** (0.032)
JUN	0.00223*** (0.001)	0.05291* (0.029)	0.00224*** (0.001)	0.04713 (0.029)
JUL	0.00104*** (0.000)	-0.44000*** (0.040)	0.00105*** (0.000)	-0.43910*** (0.039)
AUG	0.00128*** (0.000)	-0.19048*** (0.033)	-0.00130*** (0.000)	-0.18984*** (0.033)
Intercept	-0.00074** (0.000)	-0.08919*** (0.020)	-0.00084** (0.000)	-0.09053*** (0.020)
Country dummies	Yes	Yes	Yes	Yes
Observations	11,237	11,237	11,237	11,237
R-squared	0.03832	0.18334	0.03780	0.18182

Note: RET represents daily stock indices returns. CHGVOL represents the percentage change in 30-day volatility. %CASE is percentage of daily new cases over cumulative cases. %DEATH is percentage of daily new deaths over cumulative cases. CHGBMI is a quarterly change in Barro Misery Index or BMI (Barro, 1999) (%). JAN, FEB, MAR, APR, MAY, JUN, JUL, and AUG represent dummy variables for each month from January 14, 2020, through August 31, 2020 with the omitted dummy variable is entire month of September 2020. Country dummy variables are included in all regression but not reported to conserve space. Robust standard errors are reported in parenthesis below the slope coefficient. *, **, and *** represent statistically significant at 10%, 5% and 1% respectively.

Table 3
The impacts of BMI components.

	RET	RET	RET	RET	CHGVOL	CHGVOL	CHGVOL	CHGVOL
RET(t-1)	-0.01724 (0.033)	-0.01502 (0.033)	-0.01756 (0.033)	-0.01495 (0.033)				
CHGVOL(t-1)					0.06615** (0.031)	0.06917** (0.030)	0.06689** (0.031)	0.06860** (0.030)
%CASE	-0.00001 (0.000)	-0.00583* (0.003)	-0.00070 (0.002)	-0.00011* (0.000)	-0.12891 (0.098)	0.19071* (0.100)	0.04784 (0.067)	0.15665* (0.085)
CHGGDP	0.00445* (0.003)				-0.00425*** (0.001)			
%CASE x CHGGDP	-0.04987** (0.019)				0.00134*** (0.000)			
CHGINT		-0.00208*** (0.000)				0.00487** (0.002)		
%CASE x CHGINT		-0.00225* (0.001)				0.00727** (0.003)		
CHGUNE			-0.00814*** (0.000)				0.01336** (0.006)	
%CASE x CHGUNE			-0.00253*** (0.001)				0.10775* (0.055)	
CHGINF				-0.00018* (0.000)				0.00651*** (0.002)
%CASE x CHGINF				-0.00004 (0.000)				-0.05552 (0.039)
Intercept	-0.00085*** (0.000)	-0.00053** (0.000)	-0.00074*** (0.000)	-0.00043* (0.000)	-0.08483*** (0.018)	-0.13580*** (0.014)	-0.13519*** (0.014)	-0.13822*** (0.014)
Month dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,237	11,237	11,237	11,237	11,237	11,237	11,237	11,237
R-squared	0.04033	0.03964	0.03999	0.03831	0.18358	0.18116	0.18288	0.18154
	RET	RET	RET	RET	CHGVOL	CHGVOL	CHGVOL	CHGVOL
RET(t-1)	-0.01449 (0.033)	-0.01438 (0.033)	-0.01446 (0.033)	-0.01478 (0.033)				
CHGVOL(t-1)					0.06916** (0.031)	0.07062** (0.030)	0.07002** (0.030)	0.07099** (0.030)
%DEATH	-0.21052** (0.100)	-0.12200** (0.056)	-0.03332 (0.098)	-0.11881*** (0.033)	0.62993 (0.842)	0.73880* (0.406)	0.37409 (4.079)	0.50379* (0.287)
CHGGDP	0.01901*** (0.000)				-0.00522*** (0.001)			
%DEATH x CHGGDP	-0.01893** (0.008)				0.07209** (0.027)			
CHGINT		-0.00108* (0.000)				0.00393*** (0.001)		
%DEATH x CHGINT		-0.01736*** (0.002)				0.96273* (0.521)		
CHGUNE			-0.01004*** (0.000)				0.01716** (0.008)	
%DEATH x CHGUNE			-0.00701 (0.046)				0.09027 (0.242)	
CHGINF				-0.00013** (0.000)				0.00381*** (0.001)
%DEATH x CHGINF				-0.00425 (0.012)				-0.44384 (0.572)
Intercept	-0.00072** (0.000)	-0.00053** (0.000)	-0.00060** (0.000)	-0.00055** (0.000)	-0.08919*** (0.018)	-0.13531*** (0.014)	-0.14116*** (0.014)	-0.13942*** (0.014)
Month dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,237	11,237	11,237	11,237	11,237	11,237	11,237	11,237
R-squared	0.03766	0.03798	0.03764	0.03796	0.18158	0.18059	0.18128	0.18027

Note: RET represents daily stock indices returns. CHGVOL represents the percentage change in 30-day volatility. %CASE is percentage of daily new cases over cumulative cases. %DEATH is percentage of daily new deaths over cumulative cases. CHGGDP is a quarterly change in real GDP growth (%). CHGINT is a quarterly change in the long-term interest rate (%). CHGUNE is a quarterly change in the unemployment rate (%). CHGINF is a quarterly change in inflation rate (%). Month and Country dummy variables are included in all regression but not reported to conserve space. Robust standard errors are reported in parenthesis below the slope coefficient. *, **, and *** represent statistically significant at 10%, 5% and 1% respectively.

Table 4

The impacts of BMI components on emerging and developed markets.

Panel A. The Impacts of BMI Components on Emerging Markets								
	RET	RET	RET	RET	CHGVOL	CHGVOL	CHGVOL	CHGVOL
RET(t-1)	0.01365 (0.044)	0.01605 (0.044)	0.01246 (0.044)	0.01479 (0.044)				
CHGVOL(t-1)					0.11545*** (0.038)	0.11823*** (0.038)	0.11490*** (0.039)	0.11771*** (0.037)
%CASE	-0.00001 (0.000)	-0.02383*** (0.003)	-0.00175 (0.001)	-0.01227*** (0.003)	-0.12970 (0.097)	0.16737 (0.124)	0.04004 (0.066)	0.15124 (0.103)
CHGGDP	0.00568** (0.003)				-0.00413** (0.002)			
%CASE x CHGGDP	-0.07271*** (0.025)				0.00138** (0.001)			
CHGINT		-0.00121*** (0.000)				0.00592*** (0.001)		
%CASE x CHGINT		-0.00292*** (0.001)				0.00195 (0.049)		
CHGUNE			-0.00916*** (0.000)				0.01606** (0.007)	
%CASE x CHGUNE			-0.00334*** (0.001)				0.12028* (0.071)	
CHGINF				-0.00107*** (0.000)				0.0587** (0.002)
%CASE x CHGINF				-0.00106 (0.001)				-0.04923 (0.039)
Intercept	-0.00101** (0.000)	-0.00053 (0.000)	-0.00075** (0.000)	-0.00056 (0.000)	-0.07052*** (0.025)	-0.11558*** (0.017)	-0.11319*** (0.016)	-0.11938*** (0.017)
Month dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522
R-squared	0.04636	0.04553	0.04727	0.04544	0.16979	0.16699	0.16963	0.16742
Panel B. The Impacts of BMI Components on Developed Markets								
	RET	RET	RET	RET	CHGVOL	CHGVOL	CHGVOL	CHGVOL
RET(t-1)	-0.09312*** (0.030)	-0.09259*** (0.030)	-0.09298*** (0.029)	-0.09302*** (0.030)				
CHGVOL(t-1)					0.04329 (0.035)	0.04116 (0.035)	0.04153 (0.035)	0.04115 (0.035)
%CASE	-0.00913 (0.006)	-0.01348*** (0.004)	-0.01717*** (0.005)	-0.01509** (0.007)	0.21844 (0.171)	0.22904* (0.123)	0.15028 (0.201)	0.21816 (0.218)

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Table 4 (continued)

Panel B. The Impacts of BMI Components on Developed Markets								
	RET	RET	RET	RET	CHGVOL	CHGVOL	CHGVOL	CHGVOL
CHGGDP	0.00151*** (0.000)				-0.00426*** (0.001)			
%CASE x CHGGDP	-0.00466*** (0.002)				0.00028 (0.001)			
CHGINT		-0.01015*** (0.002)				0.00350*** (0.000)		
%CASE x CHGINT		-0.02543*** (0.004)				0.01792 (0.140)		
CHGUNE			-0.00068** (0.000)				0.01338** (0.006)	
%CASE x CHGUNE			-0.00309 (0.002)				0.04643 (0.088)	
CHGINF				0.00008 (0.000)				0.00534 (0.011)
%CASE x CHGINF				-0.00398 (0.006)				-0.02133 (0.183)
Intercept	-0.00233*** (0.000)	-0.00274*** (0.000)	-0.00229*** (0.000)	-0.00245*** (0.000)	-0.00460 (0.024)	-0.07636*** (0.024)	-0.10734*** (0.017)	-0.08475*** (0.022)
Month dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,715	3,715	3,715	3,715	3,715	3,715	3,715	3,715
R-squared	0.03857	0.03917	0.03956	0.03867	0.22726	0.22551	0.22587	0.22548
RET(t-1)	RET	RET	RET	RET	CHGVOL	CHGVOL	CHGVOL	CHGVOL
RET(t-1)	-0.08254** (0.029)	-0.08264*** (0.029)	-0.08293*** (0.029)	-0.08280*** (0.029)				
CHGVOL(t-1)					-0.04045 (0.034)	-0.03786 (0.035)	-0.03874 (0.035)	-0.03809 (0.035)
%DEATH	-0.51332* (0.298)	-0.03186 (0.028)	-0.16883 (0.205)	-0.02323 (0.341)	1.33007** (0.564)	2.64469 (2.397)	12.25629 (14.107)	6.73369 (8.642)
CHGGDP	0.00081** (0.000)				-0.00562*** (0.001)			
%DEATH x CHGGDP	-0.03663* (0.021)				0.18899** (0.092)			
CHGINT		-0.00590** (0.002)				0.00121*** (0.000)		
%DEATH x CHGINT		-0.10479 (0.220)				0.05029 (0.311)		
CHGUNE			-0.00102** (0.000)				0.02135* (0.011)	
%DEATH x CHGUNE			-0.05201 (0.073)				-3.59093 (5.230)	
CHGINF				-0.00006 (0.000)				0.00059 (0.013)
%DEATH x CHGINF				-0.01066 (0.341)				0.92222 (0.736)
Intercept	-0.00287*** (0.000)	-0.00280*** (0.000)	-0.00269*** (0.000)	-0.00261*** (0.000)	0.02764 (0.029)	-0.06741** (0.024)	-0.11162*** (0.017)	-0.07629*** (0.024)
Month dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,715	3,715	3,715	3,715	3,715	3,715	3,715	3,715
R-squared	0.03264	0.03198	0.03207	0.03184	0.22922	0.22559	0.22555	0.22480

Note: RET represents daily stock indices returns. CHGVOL represents the percentage change in 30-day volatility. %CASE is percentage of daily new cases over cumulative cases. %DEATH is percentage of daily new deaths over cumulative cases. CHGGDP is a quarterly change in real GDP growth (%). CHGINT is a quarterly change in the long-term interest rate (%). CHGUNE is a quarterly change in the unemployment rate (%). CHGINF is a quarterly change in inflation rate (%). Month and Country dummy variables are included in all regression but not reported to conserve space. Robust standard errors are reported in parenthesis below the slope coefficient. *, **, and *** represent statistically significant at 10%, 5% and 1% respectively.

accompanied by increases misery index (%CASExCHGBMI) create additional adverse effects on the stock markets, indicated by lower returns and greater volatility.

3.2. Impacts of BMI components

We analyze the impacts of the changes in BMI components (CHGGDP, CHGINT, CHGUNE, CHGINF) on the RET and CHGVOL in Table 3. We find that the change in GDP growth is positively associated with stock returns and negatively related to volatility, while the change in long-term interest rate is negatively stock returns and is positively related to volatility. We also find that the interaction

variables between %CASE and CHGGDP and CHGINT and %DEATH and CHGGDP and CHGINT are also related to lower returns and greater volatility. We also find that changes in unemployment and inflation rates are significantly associated with lower stock returns and greater volatility. Overall, we find that changes in all four components of BMI play critical roles and therefore they provide reasonable measures for countries' economic wellbeing.

3.3. Impacts of BMI components on emerging and developed countries

Literature has documented that the impacts of global economic shocks on emerging markets are different from those of developed countries (Girard & Biswas, 2007; Normazia et al., 2013). Topcu and Gulai (2020) find that the impact of COVID-19 in emerging stock markets is gradual. We analyze the differing impacts of BMI components' changes on stock returns and volatility for the emerging versus developed markets. We utilize the MSCI market classification to group the countries into 53 emerging markets and 23 developed markets. Panel A of Table 4 shows the regression results for emerging countries. We find that all four components of BMI significantly affect stock returns and volatility. We find that the interaction variables between GDP, interest rate and unemployment with %CASE and %DEATH brought other adverse effects to the stock returns and volatility in the emerging equity markets.

Panel B of Table 4 presents the regression results for developed countries. We find that only real GDP changes, interest rate and unemployment rate adversely affect the equity markets in developed countries. Change in the inflation rate (CHGINF) does not significantly affect stock returns and volatility in developed markets. We find that the interactions between real GDP and interest rate changes with %CASE and %DEATH bring a further decline in the stock returns. Change in interest rate and %CASE increases volatility while the change in real GDP and %DEATH increases volatility. Overall, we find that only three BMI components (GDP, interest rate, and unemployment) have significant impacts on the developed equity markets.

Since BMI data is quarterly, we conduct a robustness test using the quarterly data instead of the daily data by aggregating the daily data into quarterly data. The unreported regression results from the aggregation of daily data into three quarters of 2020 across 76 firms are consistent with the results reported in Tables 2, 3, and 4.

4. Policy discussions

A shrinkage of real GDP growth across all countries during our sample period has brought a significant decline in stock returns and an increase in volatility. This adverse impacts the declining GDP, rising unemployment, inflation, and long-term interest rates, compounded by the increasing percentage increase in daily cases and deaths from COVID-19. As we have observed, the government and the central banks continue to stimulate economic growth by fiscal and monetary expansions to reduce unemployment while keeping the inflation and the interest rate at low levels to offset the negative impact of COVID-19 cases and deaths on equity markets. Unfortunately, due to the limited sizes of monetary and fiscal policies, the emerging countries are experiencing significant challenges to conducting such expansionary policies to address the impacts of the rising misery index on the emerging equity markets without causing high inflations since high inflations will adversely affect their equity markets.

5. Conclusion

The transmission of the COVID-19 virus, measured by the number of cases and deaths, has brought an unprecedented shock on the stock markets. As the 2020 real economic indicators across countries become more available, our study contributes to the literature by exploring whether stock market returns and volatility are affected by changes in the misery index, which represents real changes in countries' economic wellbeing due to COVID-19.

Our findings indicate that the global equity markets across 76 countries reacted negatively with the misery, measured by Barro Misery Index (BMI) during the COVID-19 pandemic. We find that the shrinkage in real GDP growth and rising unemployment rate, inflation, and long-term interest rate have adversely affected stock returns and have increased volatility in the equity markets. Our findings also show that increasing cases and deaths from COVID-19 also exacerbate the adverse impact of changes in the equity markets' misery index. Furthermore, we find that all four components of the Barro Misery Index bring adverse effects to the emerging equity markets. Restoring the emerging equity markets are significantly more challenging than those in developed countries. Thus, we expect that the recoveries on the emerging equity markets are more likely to take a longer time than those in the developed markets.

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Appendix

Country	Stock Index	Freq.	Pct(%)	Country	Stock Index	Freq.	Pct(%)
Argentina	MERVAL	140	1.25	Luxembourg*	LUXXX	130	1.33
Australia*	ASX	172	1.53	Malaysia	FMBKLCI	167	1.49
Austria*	ATX	151	1.34	Malta	MALTEX	137	1.22
Bahrain	BHSEASI	145	1.29	Mauritius	SEMDEX	132	1.17
Belgium*	BEL20	168	1.5	Mexico	MEXBOL	148	1.32
Brazil	IBOVESPA	150	1.33	Mongolia	MSETOP	142	1.26
Bulgaria	SOFIX	137	1.22	Morocco	MASI	145	1.29
Cambodia	CSX	166	1.48	Netherlands*	AEX	150	1.33
Canada*	TSX	172	1.53	New Zealand*	NZSE	149	1.33
Chile	IPSA	145	1.29	Nigeria	NGSEINDX	145	1.29
China	SSE	181	1.61	Norway*	OBX	149	1.33
Colombia	COLCAP	137	1.22	Pakistan	KSE100	147	1.31
Croatia	CRO	147	1.31	Philippines	PCOMP	163	1.45
Cyprus	CYSMMAPA	112	1.0	Poland	WIG	146	1.3
Czechia	PX	146	1.3	Portugal*	PSI20	149	1.33
Denmark*	KFX	146	1.3	Puerto Rico	BPRXS	139	1.24
Egypt	EGX30	149	1.33	Qatar	DSM	144	1.28
Estonia	TALSE	145	1.29	Republic of Korea	KOSPI	175	1.56
Finland*	HEX	168	1.5	Romania	BET	150	1.33
France*	CAC	175	1.56	Russia	IMOEX	166	1.48
Germany*	DAX	172	1.53	Saudi Arabia	TASI	142	1.26
Ghana	GGSECI	141	1.25	Serbia	BELEXLIN	145	1.29
Greece	ASE	146	1.3	Singapore*	STI	171	1.52
Hungary	BUX	143	1.27	South Africa	JALSH	142	1.26
Iceland	ICEXI	144	1.28	Spain*	IBEX	170	1.51
India	NIFTY	167	1.49	Sri Lanka	CSEALL	50	0.44
Indonesia	JCI	140	1.25	Sweden*	OMX	168	1.5
Iran	TEDPIX	142	1.26	Switzerland*	SMI	152	1.35
Iraq	ISXGI	74	0.66	Thailand	SET	175	1.56
Ireland*	ISEQ	150	1.33	United Kingdom*	FTSE350	167	1.49
Israel*	TA-125	143	1.27	Tunisia	TUNINDEX	144	1.28
Italy*	FTSEMIB	172	1.53	Turkey	XU100	137	1.22
Japan*	NKY	174	1.55	Ukraine	PPTS	147	1.31
Jordan	JOSMGNFF	50	0.27	United Arab Emirates	ADSMI	169	1.5
Kazakhstan	KZKAK	134	1.19	USA*	S&P500	177	1.58
Latvia	RIGSE	140	1.25	Venezuela	IBVC	133	1.18
Lebanon	BLOM	138	1.23	Viet Nam	VNINDEX	171	1.52
Lithuania	VILSE	144	1.28	Zimbabwe	MXZWIM	138	1.23

* represents the Developed countries (source: <https://www.msci.com/market-classification>)

References

- Ashraf, B.N., 2020. Stock markets' reaction to COVID-19: Cases or fatalities? *Res. Int. Busi. Finance* 54, 101249.
- Zhang, D., Hu, M., Ji, Q., 2020. Financial markets under the global pandemic of COVID-19. *Finance Research Letters* 36, 101528. <https://doi.org/10.1016/j.frl.2020.101528>.
- Baker, S.R., Bloom, N., Davis, S.J., Kost, K.J., Sammon, M.C., Viratyosin, T., 2020. The unprecedented stock market impact of COVID-19. *Review of Asset Pricing Studies* 10 (4), 742–758.
- Azimli, A., 2020. The impact of COVID-19 on the degree of dependence and structure of risk-return relationship: A quantile regression approach. *Finance Res. Lett.*, 101648
- Barro, R.J., 1999. Reagan vs. Clinton: Who's the economic champ? *Business Week* 22. February 22 Available at. <https://scholar.harvard.edu/barro/publications/reagan-vs-clinton-whos-economic-champ>.
- Barro, R.J., Ursua, J.F., Weng, J., 2020. The coronavirus and the great influenza pandemic: lessons from the "Spanish Flu" for the coronavirus's potential effects on mortality and economic activity. National Bureau of Economic Research Working Paper No. w26866.
- Clark, P.K., 1973. A subordinated stochastic process model with finite variance for speculative prices. *Econometrica* 41, 135–155.
- Darolles, S., Foi, G., Mero, G., 2017. Mixture of distribution hypothesis: Analyzing daily liquidity frictions and information flows. *J. Economet.* 201 (2), 367–383.
- Ekren, N., Alp, E.A., Yağmur, M.H., 2017. Macroeconomic performance index: a new approach to calculation of economic wellbeing. *Appl. Econ.* 49 (53), 5462–5476.
- Epps, T.W., Epps, M.L., 1976. The stochastic dependence of security price changes and transaction volumes: Implications for the mixture-of-distribution hypothesis. *Econometrica* 44, 305–321.
- Fernandez, N., 2020. Economic effects of Coronavirus outbreak (COVID-19) on the world economy. Working paper. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3557504.
- Girard, E., Biswas, R., 2007. Trading volume and market volatility: Developed versus emerging stock markets. *Financ. Rev.* 42, 429–259.
- Goodell, J.W., 2020. COVID-19 and finance: Agendas for future research. *Finance Res. Lett.* 35, 101512. <https://doi.org/10.1016/j.frl.2020.101512>. July 2020 Available at.
- Goodell, J.W., Huynh, T.L.D., 2020. Did Congress trade ahead? Considering the reaction of US industries to COVID-19. *Finance Res. Lett.* 31, 101578. May 2020.
- MacKinnon, D., White, H., 1985. Some heteroskedasticity-consistent covariance matrix estimators with improved finite sample properties. *J. Economet.* 29 (3), 305–325.

- Normazia, M., Hassan, T., Ariff, M., Shamsher, M., 2013. Private placement, share prices, volume and financial crisis: An emerging market study. *Glob. Finance J.* 24 203–221.
- Onali, E., 2020. COVID-19 and stock market volatility. Working Paper. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3571453.
- Ramelli, S., Wagner, A.F., 2020. Feverish stock price reactions to COVID-19. *Review of Corporate Finance Studies* 9 (3), 622–655.
- Shehzad, K., Xiaoxing, L., Kazouz, H., 2020. COVID-19's disasters are perilous than Global Financial Crisis: A rumor of fact? *Finance Res. Lett.*, 101669
- Topcu, M., Gulai, O.S., 2020. The impact of COVID-19 on emerging stock markets. *Finance Res. Lett.*, 101691
- Welsch, H., 2007. Macroeconomics and life satisfaction: Revisiting the "Misery Index. *J. Appl. Econ.* 10 (2), 237–251.
- World Health Organization (WHO). 2020. Coronavirus disease (COVID-2019) situation reports. Available at <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>.