Routledge
Taylor & Francis Group

Economic Research-Ekonomska Istraživanja

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rero20

Influence of COVID-induced fear on sovereign bond yield

Jessica Paule-Vianez, Carmen Orden-Cruz & Sandra Escamilla-Solano

To cite this article: Jessica Paule-Vianez, Carmen Orden-Cruz & Sandra Escamilla-Solano (2022) Influence of COVID-induced fear on sovereign bond yield, Economic Research-Ekonomska Istraživanja, 35:1, 2173-2190, DOI: 10.1080/1331677X.2021.1934509

To link to this article: https://doi.org/10.1080/1331677X.2021.1934509

Published online: 07 Jun 2021.

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA
2022, VOL. 35, NO. 1, 2173–2190
https://doi.org/10.1080/1331677X.2021.1934509

Influence of COVID-induced fear on sovereign bond yield

Jessica Paule-Vianez, Carmen Orden-Cruz and Sandra Escamilla-Solano

University of Rey Juan Carlos, Madrid, Spain

ABSTRACT

There is limited literature exploring the relationship between the sentiment of fear and bond markets. This study analyzes the influence of fear generated by the coronavirus on bond markets, particularly on the yield of sovereign bond debt issued by the G7 countries (Germany, Canada, the United States, France, Italy, Japan, and the United Kingdom). To accomplish this, search volumes compiled by Google Trends on the topic of coronavirus were used as a proxy for COVID-induced fear. The results from applying a panel data approach for the period from 1 January 2020 to 30 December 2020, show that this fear positively impacts the 10-year sovereign bond yield. We show that a one-point increase in COVID-induced fear was associated with an increase in the weekly change in the sovereign bond yield of around 0.0007%. Thus, we found that COVID-induced fear was associated with an increase in country risk perception. These findings have important implications for policymakers by demonstrating the importance of searching a balance between health concerns and impacts on the economy to avoid increasing country risk. In addition, the results obtained show that in times of greater fear of the coronavirus, investors can obtain higher returns by investing in safe assets, such as sovereign bonds.

ARTICLE HISTORY
Received 31 March 2021
Accepted 20 May 2021

KEYWORDS
COVID-19; fear; sovereign bonds; yield; Google Trends; behavioral finance

JEL CLASSIFICATIONS
G41; D81; G15; C33

1. Introduction

The COVID-19 pandemic has shaken economies and financial markets worldwide since the World Health Organization (WHO) officially declared it a pandemic on 11 March 2020, changing the foundations of world order (Chang et al., 2020). This pandemic has led to a transformation in economies and markets on a scale never seen since the Great Depression of 1929 (Laing, 2020) and a macroeconomic impact, which is more significant than any catastrophe experienced in the last forty years (Andries et al., 2020; Ludvigson et al., 2020). Countries are facing deep economic recessions caused by the confinements experienced in 2020 (Boettke & Powell, 2021), an increase in unemployment, a sharp drop in international trade, expansion in fiscal

CONTACT Jessica Paule-Vianez jessica.paule@urjc.es

deficits (Bai et al., 2021), as well as a change in the mobility of society when carrying out tourist activities (Hall et al., 2020).

The sentiment that COVID-19 represents in our lives is the fear of the unknown and is transferred to all areas, especially to the world's financial and economic systems (Phan & Narayan, 2020). The feeling of anxiety caused by the fear associated with the number of deaths caused by COVID-19 produces a spread of panic in every respect (Aslam, Mohti, et al., 2020). Although previous studies have analyzed the impact that COVID-induced fear has had on stock markets (Lyócsa et al., 2020; Salisu & Akanni, 2020), cryptocurrencies (Chen et al., 2020) and commodity prices (Salisu et al., 2020a); to our knowledge, there is no literature investigating the possible influence of COVID-19 fear on bond markets.

In this study, we analyze the impact of COVID-induced fear on bond markets, specifically on sovereign bond yields. We start with the assumption that this fear should increase the perception of country risk due to the negative effects of the pandemic on fiscal fundamentals. A higher perceived risk should be reflected in an increase in the yield required for investing in public debt.

To achieve the proposed objective, the 10-year sovereign bond yield of the G7 countries (Germany, Canada, the United States, France, Italy, Japan, and the United Kingdom) was selected as a reference. As a proxy for COVID-induced fear, search volumes for the term coronavirus from Google Trends were taken in line with studies such as those by Chen et al. (2020) and Vasileiou (2021). Thus, by applying a panel data approach for the period from 1 January 2020 to 31 December 2020, we found that this fear has a positive impact on the 10-year sovereign bond yield. This result has significant implications for public authorities and investors. Policymakers should try to find a balance between health concerns and impacts on the economy by sending positive signs about the prospects of fiscal measures that avoid a deterioration in a country's risk assessment. Meanwhile, investors can take advantage of excessive market reactions to this kind of shock, considering that sovereign bonds are one of the safest and liquid assets.

This study contributes to the literature in four ways: (1) we add new research to the limited number of studies on the relationship between COVID-19 and fixed-income markets that have evaluated the relationship between the COVID factor and the bond market by considering the pandemic as a shock and using the number of cases and deaths, and lockdown measures as variables (Andries et al., 2020; Cevik & Öztürkkal, 2020), in addition to considering the sentiment of fear, which has not been considered in previous studies; (2) we provide new insights to existing behavioral finance studies on the role of fear in financial markets and its implication, specifically on the sovereign bond market, which to our knowledge, has not yet been explored; (3) we make new contributions regarding the use of Google Trends search volume data of COVID-19 as an indicator of public fear for measuring the impact on debt markets not yet explored; and, in this way, (4) we fill a gap in the literature related to the impact that the sentiment of fear caused by the coronavirus has on the government debt market.

The paper is structured as follows. In Section 2, the review of the literature involved in the study is addressed. In Section 3, the data and methodology used is

described. In Section 4, the results obtained are presented and discussed. Finally, Section 5 shows the conclusions drawn from the study.

2. Literature review

After the World Health Organization declared the COVID-19 pandemic a global health emergency, the worlds' economies experienced dramatic declines and unprecedented government interventions were unleashed (Lahmiri & Bekiros, 2020; Zaremba et al., 2020). The rapid spread of the virus and high mortality rates generated significant concern, fear and even panic among the population, regardless of location and exposure to COVID-19 (Nicomedes & Avila, 2020).

Such is the importance of COVID-19 in the world that, in a short time, multiple studies have analyzed the influence of the pandemic on different aspects such as geopolitics (Heisbourg, 2020; Sharif et al., 2020), socioeconomics (Nicola et al., 2020a; van Barneveld et al., 2020), healthcare policy (Nicola et al., 2020b), the sharing economy (Batool et al., 2020), socially responsible investment (Mirza, Naqvi, et al., 2020) or climate change policy (Cole & Dodds, 2021). Studies that analyze the impact that COVID-19 has on the solvency of companies can also be found (Mirza, Rahat, et al., 2020) or how COVID-19 has affected the credit portfolios of financial institutions (Yarovaya et al., 2020a).

The influence of COVID-19 on financial markets has been a topic of great academic interest. Several studies have analyzed the impact of COVID-19 on stock markets (Al-Awadhi et al., 2020; Baker et al., 2020; Gao et al., 2021; Rizvi, Yarovaya, et al., 2020; Zhang et al., 2020), mutual funds (Mirza, Naqvi, et al., 2020; Mirza, Hasnaoui, et al., 2020; Rizvi, Mirza, et al., 2020; Yarovaya et al., 2020b, 2021), the currency market (Ali et al., 2020; Aslam, Aziz, et al., 2020; Umar & Gubareva, 2020), commodity markets (Mensi et al., 2020), as well as on cryptocurrencies (Conlon et al., 2020; James et al., 2021; Umar & Gubareva, 2020). However, this effect has hardly been analyzed in the fixed-income market despite Grund (2020) noting that the emergence of COVID-19 caused countries' sovereign spreads to increase rapidly. When considering an increase in the number of deaths from COVID-19 related infections and quarantine measures, it is observed an escalation of sovereign risk premiums. This impact has been evidenced by Andries et al. (2020) using event study methodology and Cevik and Öztürkkal (2020) performing a granular analysis with high-frequency (daily) data. Meanwhile, Ettmeier et al. (2020) showed an increase in interest rates along the yield curve.

When analyzing different bond pricing models, the COVID factor has added an extra impact on Mexican bond risk premiums (Christensen et al., 2020) and on the U.S. municipal bond market, in which the initial negative influence was offset by the U.S. Federal Reserve interventions (Bi & Marsh, 2020; Bordo & Duca, 2021; Cipriani et al., 2020).

The literature mentioned so far focused on COVID-19 as an external shock that influenced financial markets, but it has also been researched from a behavioral perspective. Bansal (2020) analyzed how cognitive errors and biases affected financial institutions and markets during and after the COVID-19 crisis. Mann et al. (2020)

examined demographic and individual correlations for distress anxiety the day after historical stock market crashes due to the declaration of the COVID-19 pandemic. Zaremba et al. (2020) researched the impact of government interventions to curb the spread of COVID-19 on stock market volatility. Salisu et al. (2020b) studied the response of emerging equity markets to the uncertainty of pandemics and epidemics, including the COVID-19 pandemic.

Among the sentiments associated with COVID-19, COVID-induced fear has been highlighted (Samuel et al., 2020). In this respect, Phan and Narayan (2020) consider fear of COVID-19 as the father of all fears impacting the economy and financial markets. More recent literature analyzed the influence of COVID-induced fear on financial markets by using different proxies of fear inspired by previous literature (Da et al., 2015; Smales, 2016; Whaley, 2000; Zhu et al., 2019). Salisu and Akanni (2020) created a composite index of fear, the Global Fear Index (GFI) to explain how much of the distortions in financial markets can be attributed to the pandemic. The GFI uses published information on the number of cases and deaths reported by COVID-19, collected by the European Center for Disease Prevention and Control (ECDC), and the index varies from 0 to 100, with 50 being a moderate fear value and 100 being extreme fear. The authors found that the GFI has a significant explanatory and predictive power for the stock market returns of OECD and BRICS countries, which is better than the previously used volatility index (VIX). On the other hand, Lyócsa et al. (2020), used Google Search Volume (GSV) activity as an indicator of fear and confirmed the predictive power of COVID fear for the variation of stock market prices. Subramaniam and Chakraborty (2021) also corroborate a robust negative association between the COVID-19 fear index and stock returns using GSV activity of the search terms related to COVID-19 words and phrases contained in Google and Internet dictionaries. Vasileiou (2021) also used a coronavirus fear index based on Google searches for the term 'coronavirus' to analyze stock market efficiency, demonstrating how this fear influences U.S. stock market performance negatively. By using the RavenPack finance for the Panic Index, Global Sentiment Index, and Media Coverage, Haroon and Rizvi (2020) even show how panic-laden news contributes to higher stock market volatility, especially in the sectors perceived to be most affected by the pandemic. In relation to cryptocurrencies, Chen et al. (2020) explained the negative returns and high trading volume of Bitcoin by fear sentiment as a result of an increase in search interest in coronavirus. Meanwhile, Van Hoang and Syed (2021) explored the impact on currency and commodity markets through the Credit Suisse Fear Barometer (CSFB) and the VIX and suggest that investor fear sentiment during COVID-19 has a different nature from the 2008 crisis, thus losing the predictive power of the CSFB. Salisu et al. (2020a) focused on commodity price returns, which evidence a positive relationship with the GFI. Moreover, Lahmiri and Bekiros (2020) tried to understand how the pandemic shaped fear and expectations in investors worldwide. They analyzed the multiscale entropy function in the return time series of Bitcoin, S&P500, WTI, Brent, Gas, Gold, Silver, and the investor fear index, concluding that the pandemic has not influenced investors´ expectations.

Analyzing the impact of the sentiment of fear is relevant, particularly in bond markets. Haugh et al. (2009) showed how the 2008 financial crisis magnified the

importance of fiscal performance, leading to large movements in the sovereign bond yield spread in the euro area. Bordon et al. (2014) confirmed this relationship by analyzing the noticeable overpricing of sovereign bonds for the so-called GIIPS countries during the financial crisis. Baldacci and Kumar (2010) re-examined this effect during 1980–2008 and concluded that higher deficits and public debt lead to a significant increase in long-term interest rates. Research also reveals the importance of financial market experts' expectations concerning the fiscal discipline for sovereign risk perception (Montes & Costa, 2020).

From a behavioral finance point of view, investor sentiment is a factor that goes beyond the traditional explanation based on the information contained in the term structure of bonds and macroeconomic factors. Nayak (2010) found that corporate bond yield spreads co-vary with sentiment by registering higher yields during pessimistic periods and lower yields at optimistic moments. By using four decades of U.S. Treasury bond data, Laborda and Olmo (2014) found evidence that bond risk premiums can be explained by investor sentiment dynamics as a predictive factor, being more relevant during recession periods. Further evidence is found with U.S. speculative bonds; Muldur et al. (2019) pointed out that investor sentiment is a systematic risk factor in risky bonds. Their yield spreads co-vary with investor sentiment. Baker and Wurgler (2012) explored the effect of investor sentiment on bond-like stocks, confirming a strong movement with government bonds when investor sentiment is high, and there is an expectation of higher bond-like stocks returns than speculative stocks.

Under the current stressful environment, Naeem et al. (2021) analyzed the dynamic relationship between global stock market fear and alternative asset markets (oil, gold, currency and bond) and found that it is connected in the opposite sense to bond market fear. Only Andries et al. (2020) suggested that the increased number of infected cases and deaths and quarantine measures, especially at the beginning of the pandemic, generated uncertainty among investors, leading to an increase in sovereign risk premiums. Therefore, there is very limited literature on the influence of COVID on bond markets and, to our knowledge, no study considers the effect of COVID-induced fear on this market. Sovereign bond markets are of particular interest, where sentiments could affect the perception of country risk. In this context, this paper attempts to shed light on the study of the impact of COVID-induced fear on the yield of sovereign bonds and to contribute to the existing behavioral finance literature on the role of fear in financial markets and its implications.

3. Data and methodology

To study the impact of COVID-induced fear on sovereign yields, a sample of weekly data was taken for the G7 countries for the period from 1 January 2020 to 31 December 2020. The G7 countries were selected because, in addition to being the nations with the most significant political, economic, and military weight, they are also some of the countries most affected by COVID-19 (Italy, France, Germany, United Kingdom, United States, and Canada) (Arif et al., 2021; Salgotra et al., 2020), so they represent a significant sample to analyze the relationship under study. The

first sample date was 1 January 2020, because on 31 December 2019 the world was notified of the first cluster of coronavirus cases in Wuhan (China).

In this study, the search volume for the coronavirus concept extracted from Google Trends (https://trends.google.com/trends/) was selected as a proxy for COVID-induced fear. This measure can be found in previous papers such as Chen et al. (2020) and Vasileiou (2021). Since Google Trends was launched in 2006, it has been used as a primary data source in multiple research studies. Google Trends provides a free and publicly available query index that describes search volume as a number between zero and one hundred and enables data to be sorted by categories such as geographic location, activity and others. In this study, the 'search by the topic' was chosen, and the topic 'coronavirus' was selected as of January 2020, taking the search volumes of this topic for the whole year. This selection included virus-related queries instead of an exact term, allowing for the inclusion of several synonyms, spelling errors, and translations from different languages in the analysis (Szmuda et al., 2020).

Figure 1 presents the evolution of COVID-induced fear extracted from Google Trends during 2020. It shows that fear maximums were reached in March, with Italy being the first country of those analyzed to hit its maximum. Italy, which was the first country in the European Union to detect COVID-19 cases, reached its maximum fear level in the first week of March, which was the period of coronavirus spread in this country and the implementation of restrictive measures by its government. Subsequently, Germany, France, United Kingdom, United States and Canada recorded their highest fear levels in the second week of March, when the World Health Organization declared the COVID-19 outbreak a pandemic. Finally, Japan recorded its peak in the last week of March, coinciding with establishing tighter restrictions in the country due to an explosive increase in infections.

Sovereign yield data were extracted on a weekly basis from Investing (https://es.investing.com). The 10-year Treasury bond yield of each country was taken as a reference because it is the most commonly accepted benchmark for measuring country risk.

In addition, for the approach of a model with which to evaluate the influence of COVID-induced fear on the sovereign bond market, this study selected control variables, which is in line with other studies that have associated the sovereign bond yield with COVID-19: the country's benchmark stock index (Gherghina et al., 2020; Papadamou et al., 2021), the country's currency exchange rate (Gherghina et al., 2020), gold futures (Gherghina et al., 2020) and oil futures (Gherghina et al., 2020). The data for these variables were extracted from Investing. It should be noted that other relevant variables, such as government debt, have not been included because they were not available on a weekly or daily basis.

The variables used in this study and their definition are shown in Table 1.

Table 2 shows the descriptive statistics of the variables under study for the data sample. Considering the bond yield, it was shown that the mean yield was 0.34%, and a minimum yield of 0.71% was found for the German bond at the beginning of March, and a maximum yield of 1.89% for the Italian bond in mid-April. Analyzing COVID-induced fear, the mean level of 19.31 was found, with highs in March (100)

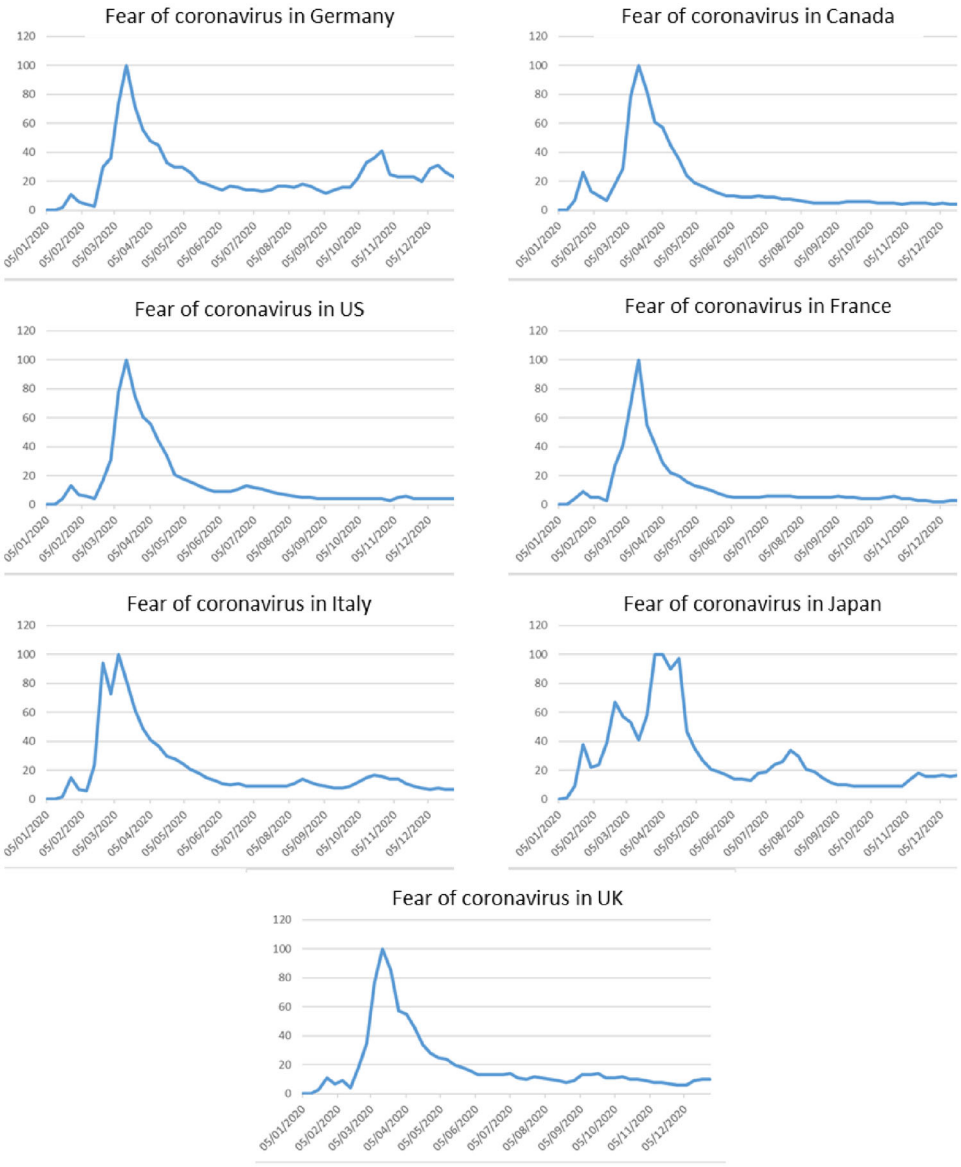

Figure 1. Evolution of COVID-induced fear in the G7 countries between 1 January 2020 and 31 December 2020.
Source: Authors.

and lows (0) at the beginning of January in all the countries studied. Focusing on the control variables, the average stock index return was 0.12%, with the most significant price drop in the second week of Mar4ch in the Italian stock market, with a return of −23.3% and a maximum of 17.14% in the Nikkei index in mid-March. In the case of the exchange rate, the mean variation was 0.11%, with the minimum and maximum being found in the exchange rate variation of GBP against the USD, with a depreciation of −5.92% and an appreciation of 7% in March. The average return on gold was 0.40%, with a minimum variation of −9.39% in the second week of March and a

Table 1. Variables used to analyze the influence of COVID-induced fear on the sovereign bond yield.

Variable	Definition
Bond	Weekly 10-year sovereign bond yield of each country
Fear	COVID-induced fear in each country
Stock	Weekly return of the country's benchmark stock index
Exchange	Weekly exchange rate variation of the country's currency against the US dollar
Gold	Weekly return of gold futures
Oil	Weekly return of oil futures

Source: Authors.

Table 2. Descriptive statistics of the variables under study.

Variable	Obs.	Mean (%)	Standard Deviation (%)	Minimum (%)	Maximum (%)
Bond	364	0.3420852	0.5983098	−0.713	1.89
Fear	364	19.30769	21.84314	0	100
Stock	364	0.1221703	4.631939	−23.3	17.14
Exchange	364	0.1132143	1.307147	−5.92	7
Gold	364	0.4026923	3.220241	−9.39	10.69
Oil	364	0.0065384	10.53182	−25.23	36.82

Source: Authors.

Table 3. Bivariate correlations of the variables under study.

Variable	Bond	Fear	Stock	Exchange	Gold	Oil
Bond	1.0000					
Fear	−0.0299	1.0000				
	(0.5692)					
Stock	−0.0247	−0.2521	1.0000			
	(0.6390)	(0.0000***)				
Exchange	−0.0712	−0.1099	0.3730	1.0000		
	(0.1751)	(0.0360**)	(0.0000***)			
Gold	−0.0188	−0.0028	0.4148	0.4470	1.0000	
	(0.7211)	(0.9574)	(0.0000***)	(0.0000***)		
Oil	−0.0414	−0.2681	0.4113	0.1305	0.0165	1.0000
	(0.4312)	(0.0000***)	(0.0000***)	(0.0127***)	(0.7533)	

Note: ***Indicate significance at the 1% level.
**indicate significance at the 5% level and
*indicate significance at the 10%.
Source: Authors.

maximum of 10.69% during the week of March 16–22. Finally, regarding oil futures returns, the mean was found to be 0.01%, with a minimum of −25.23% in the second week of March and a maximum return of 36.82%.

Table 3 contains the correlations between the different variables studied. All of them are below 0.90, which is the maximum threshold suggested by Hair et al. (2010), so the multicollinearity problem is not shown in this study. It is observed that the correlation between the sovereign bond yield and COVID-induced fear is not significant, as is the case when analyzing the sovereign bond yield in relation to the control variables. Regarding COVID-induced fear, it is revealed that it is negatively and significantly correlated with stock market returns, the exchange rate variation, and oil returns, without finding a significant relationship with gold returns. Regarding the control variables, it is shown that the stock index return is positively and significantly correlated with the exchange rate variation, the oil return and the gold return. Likewise, it is observed that the exchange rate variation is positively and significantly correlated with oil and gold returns.

Table 4. Study of the stationarity of the variables with the Breitung and Das (2005) test.

	Integration order 0				Integration order 1			
	Without tendency		With tendency		Without tendency		With tendency	
Variable	Stat.	*p* value	Stat.	*p* value	Stat.	*p* value	Stat.	*p* value
Bond	−0.4099	0.3409	−0.7926	0.2140	−11.6957	0.0000***	−12.1096	0.0000***
Fear	−3.2365	0.0006***	−2.3754	0.0088***	−10.7772	0.0000***	−10.4584	0.0000***
Stock	−12.8225	0.0000***	−12.4441	0.0000***	−15.9220	0.0000***	−15.8050	0.0000***
Exchange	−11.6970	0.0000***	−12.7499	0.0000***	−14.9575	0.0000***	−14.3341	0.0000***
Gold	−15.4182	0.0000***	−15.1775	0.0000***	−16.8645	0.0000***	−16.7737	0.0000***
Oil	−11.1736	0.0000***	−12.1824	0.0000***	−14.6698	0.0000***	−14.8044	0.0000***

Note: ***Indicate significance at the 1% level.
**indicate significance at the 5% level and
*indicate significance at the 10%.
Source: Authors.

To achieve the proposed objective, since the data used has both temporal and cross-sectional dimensions, firstly, the stationarity of the variables under study was analyzed with the Breitung and Das (2005) test. This test was chosen due to having greater power than traditional individual time series tests (Hlouskova & Wagner, 2006).

Table 4 shows the results obtained when applying the Breitung and Das (2005) test (null hypothesis existence of unit root). The findings show that all the variables are stationary except for the bond yield, which has a unit root. By including a difference, all variables are stationary.

Based on the results obtained when studying stationarity and following Enders (2004), since not all the variables are integrated in the same order, we ruled out the use of cointegration analysis.

Therefore, to solve the problem of spurious regression in the face of non-stationary variables, this study proposed the introduction of a difference to the sovereign bond yield variable to eliminate the unit root problem (Montero, 2013) and subsequently to apply panel data analysis.

The panel data analysis made it possible to assess the explanatory power of some variables over others when data that combined a time dimension with other cross-sectional variables were available. This method treated the data set of each unit of analysis independently over time, which is known as individual effects.

It was essential to determine whether the individual effect was correlated with the explanatory variables or not. For this, the Hausman (1978) test was applied, which made it possible to determine if the panel data analysis was more consistent based on the fixed effects model (individual effect correlated with explanatory variables), or on the random effects model (individual effect not correlated with explanatory variables). The test results showed that the random effects model was more consistent with the sample of data used (see Tables 5–7).

Therefore, the model proposed in this study to analyze the influence of COVID-induced fear on sovereign bond yields is as follows:

$$d.Bond_{it} = \alpha + \beta_1 Fear_{it} + \beta_2 Stock_{it} + \beta_3 Exchange_{it} + \beta_4 Gold_{it} + \beta_5 Oil_{it} + w_i + \varepsilon_{it}, \quad t = 1, 2, \ldots, \quad T. \tag{1}$$

Table 5. Regression results of the influence of COVID-induced fear on sovereign bond yields not including control variables.

d.Bond	Coefficient	Standard Error	z	*p* value	[95% Confidence. Interval]	
Cons.	−0.0233710	0.0068679	−3.40	0.001***	−0.0368318	−0.0099102
Fear	0.0006303	0.0002335	2.70	0.007***	0.0001726	0.0010879
Hausman			0.0203906			
(*p* value)			(0.8865)			
Breusch Pagan			2.66142			
(*p* value)			(0.1028)			
R^2 within			0.0186			
R^2 between			0.3855			
R^2 overall			0.0201			
N. Obs			357			
N. Groups			7			

Note: ***Indicate significance at the 1% level.
**indicate significance at the 5% level and
*indicate significance at the 10%.
Source: Authors.

Table 6. Regression results of the influence of COVID-induced fear on sovereign bond yields.

d.Bond	Coefficient	Standard Error	z	*p* value	[95% Confidence. Interval]	
Cons.	−0.0216236	0.0066007	−3.28	0.001***	−0.0345607	−0.0086865
Fear	0.0007714	0.0002305	3.35	0.001***	0.0003197	0.0012231
Stock	0.001339	0.0012917	1.04	0.300	−0.0011928	0.0038708
Exchange	−0.0015208	0.0041675	−0.36	0.715	−0.009689	0.0066473
Gold	−0.0113421	0.0017542	−6.47	0.000 ***	−0.0147802	−0.007904
Oil	0.0006205	0.0005102	1.22	0.224	−0.0003795	0.0016204
Hausman			2.51873			
(*p* value)			(0.1125)			
Breusch Pagan			0.291034			
(*p* value)			(0.9617)			
R^2 within			0.1593			
R^2 between			0.3709			
R^2 overall			0.1602			
N. Obs			357			
N. Groups			7			

Note: ***Indicate significance at the 1% level.
**indicate significance at the 5% level and
*indicate significance at the 10%.
Source: Authors.

where $d.Bond_{it}$ is the dependent variable of the model, α is the constant term, β_k is the regression coefficient of each explanatory variable k, w_i is a random variable of individual effects, and ε_{it} is the error term.

4. Results and discussion

This section discusses the results obtained by analyzing the influence of COVID-induced fear on sovereign bond yields.

As a first approximation, we considered the random effects model without including control variables. Thus, Table 5 shows how COVID-induced fear had a positive and significant impact on sovereign yields with a significance level below 0.01%. It shows that, without considering any additional regressor variables, a one-point increase in this fear is associated with an increase in the weekly variation of the bond yield of 0.00063%.

Table 7. Regression results of the influence of COVID-induced fear on the sovereign bond yield considering robust standard errors.

d.Bond	Coefficient	Robust Standard Error	z	*p* value	[95% Confidence. Interval]	
Cons.	−0.0216236	0.0065211	−3.32	0.001***	−0.0344048	−0.0088424
Fear	0.0007714	0.0003097	2.49	0.013**	0.0001644	0.0013784
Stock	0.001339	0.0036415	0.37	0.713	−0.0057982	0.0084762
Exchange	−0.0015208	0.0057189	−0.27	0.790	−0.0127296	0.0096879
Gold	−0.0113421	0.0018405	−6.16	0.000***	−0.0149493	−0.0077349
Oil	0.0006205	0.0003439	1.80	0.071*	−0.0000535	0.0012944
Hausman			2.00641			
(*p* value)			(0.5711)			
Breusch Pagan			2.51873			
(*p* value)			(0.1125)			
R^2 within			0.1593			
R^2 between			0.3709			
R^2 overall			0.1602			
N. Obs			357			
N. Groups			7			

Note: ***Indicate significance at the 1% level.
**indicate significance at the 5% level and
*indicate significance at the 10%.
Source: Authors.

Having observed the independent impact of COVID-induced fear on sovereign bond yields, we will now analyze whether the significant influence found still remains when including the proposed control variables in the model presented in the previous section. Therefore, Table 6 shows that when the control variables were considered, COVID-induced fear had a positive and significant impact with over 99% confidence on the sovereign bond yield. Specifically, assuming that the control variables were held constant, a one-point increase in this fear was found to be associated with an increase in the weekly variation of the bond yield of 0.00077%. Regarding the influence of the control variables in the model, it was found that the gold return also had a significant impact on the sovereign bond yield, only that in this case, the effect was negative.

The regression analysis results showed that the increase in COVID-induced fear contributed to an increase in sovereign bond yields. This finding is in line with previous research (Andries et al., 2020; Cevik & Öztürkkal, 2020), but these studies used the number of cases and deaths, and public health containment responses derived from COVID-19 data. Only Andries et al. (2020) inferred in their event study that a higher number of infected cases and deaths, and quarantine measures generated uncertainty among investors resulting in an escalation of sovereign risk premiums.

Therefore, the findings of this study provide new evidence that COVID-19 had a significant impact on the yield of public debt, resulting in an increase in the risk premiums of sovereign bonds. Furthermore, these results also support studies of the 2008 financial crisis on country risk that found an increase in sovereign debt yields. Evidence presented by Haugh et al. (2009) showed that the importance of fiscal performance was magnified during the financial crisis, Baldacci and Kumar (2010) noted the role played by deficits and public debt in country risk assessment, and Bordon et al. (2014) indicated a higher sensitivity to country risk for those countries with the worst records of fiscal imbalances. In the same vein, the COVID factor was a shock like the 2008 financial crisis, the macro-fiscal cost of government rescue efforts

resulting from the impact of the pandemic on the economy generated an immediate fear of higher fiscal deficits and debt leading to a deterioration of country risk. In this regard, the effects of the COVID factor are not only felt in the short term, but also in the long term as Cevik and Öztürkkal (2020) suggested by forecasting the possibility of higher sovereign financing costs

From a behavioral perspective, this result supports previous studies such as those by Laborda and Olmo (2014) in the case of the US Treasury bond market and Muldur et al. (2019) with risky bonds showing how sentiments can explain bond risk premiums. Moreover, specifically, the positive relationship between COVID-induced fear and the sovereign bond yield supports what was obtained by Naeem et al. (2021), showing that while this fear is associated with reductions in stock market returns (Lyócsa et al., 2020; Salisu & Akanni, 2020; Vasileiou, 2021), it is also associated with increases in bond yields.

To demonstrate the robustness of the model, the consideration of robust standard errors was introduced to detect the possible presence of serial correlation. Table 7 shows the results obtained with a robust standard error analysis. It was found that the impact of COVID-induced fear on sovereign bond yields remained significant at a significance level of 0.001. Likewise, the influence of the return on gold continued to remain significant and when considering the robust standard error, a positive and significant impact of oil futures returns on the sovereign bond yield was also found.

In this way, the results reliably showed how COVID-induced fear has been reflected in increases in 10-year sovereign bond yields in the G7 countries.

5. Conclusions

Since the declaration of a COVID-19 pandemic, extensive literature has focused attention on the impact that this shock has on financial markets. From a behavioral finance perspective, most studies have focused on the influence of this fear on stocks, currencies, and commodities, but no literature has been found associating this fear with bonds. This paper explores the influence of COVID-induced fear, particularly on sovereign bond markets, due to their relevance as a barometer of country risk.

To achieve this objective, the search volume of the term coronavirus was taken from Google Trends as a proxy for the COVID-induced fear for the G7 countries. Applying a panel data approach, the results of this study showed that COVID-induced fear has a positive and significant impact on sovereign bond yields. The results demonstrated that COVID-induced fear increases the perception of country risk due to the possible negative impacts of this pandemic on sovereign default risk. This finding suggests that the COVID factor can explain investors´ behavior, even with sovereign bonds of countries that have the lowest levels of country risk, such as Germany. In the short term, the immediate impacts of COVID-induced fear is not consistent with the 'flight-to-quality' phenomenon, which is usually observed during periods of poor market sentiment, although this phenomenon emerges over time.

The findings obtained in this study have important implications for policymakers and investors. Public authorities should address the public health concerns of the coronavirus but, at the same time, try to stimulate the economy to avoid increasing its

debt financing costs. In its early and middle stages, COVID-19 generated significant levels of fear but, as the pandemic comes under control, the fear of fiscal imbalances will probably re-emerge and there will still be no support involving the current extraordinary monetary stimulus. Therefore, governments should not underestimate fiscal risks because investors could adjust sovereign yields, particularly in those countries that have historically shown less fiscal discipline. Evidence has shown that measures taken to reinforce institutions (Butler & Fauver, 2006) and reduce political instability (Agnello & Sousa, 2014) could support country risk assessment.

Regarding investors, the results show the possibility of considering investing in sovereign debt when fear of COVID-19 increases in order to take advantage of higher returns from one of the assets with the lowest default risk. Traditionally, low sentiment periods finally become an opportunity for investing. Furthermore, sovereign bonds are one of the safest and liquid assets in unstable times, reinforcing their 'flight to quality (safety)' and 'flight to liquidity' denominations. This issue raises the strategy of investing in public debt when constructing investment portfolios to diversify risk with other assets that typically exhibit higher volatility as the pandemic continues and also, in times of widespread fear due to other factors.

Finally, we are aware of the limitations of this study, since only seven countries were used to analyze the influence of COVID-induced fear on sovereign bond yields. This issue should encourage future researchers to investigate and compare the results obtained in this study with other countries and other types of fixed income. Moreover, in line with the results of this paper, future studies should focus on the construction of efficient portfolios after considering the effect of COVID-induced fear on asset allocation and risk diversification in portfolio construction.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Jessica Paule-Vianez http://orcid.org/0000-0001-8918-582X

References

Agnello, L., & Sousa, R. M. (2014). The determinants of the volatility of fiscal policy discretion. *Fiscal Studies*, *35*(1), 91–115. https://doi.org/10.1111/j.1475-5890.2014.12024.x

Al-Awadhi, A. M., Alsaifi, K., Al-Awadhi, A., & Alhammadi, S. (2020). Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns. *Journal of Behavioral and Experimental Finance*, *27*, 100326. https://doi.org/10.1016/j.jbef.2020.100326

Ali, M. H., Kareem, H. B., & Barrak, J. I. (2020). Uses of the revised exchange rate to maintain fair value of assets under covid.19 crisis. *Industrial Engineering & Management Systems*, *19*(4), 932–948. https://doi.org/10.7232/iems.2020.19.4.932

Andries, A. M., Ongena, S., & Sprincean, N. (2020). *The COVID-19 pandemic and sovereign bond risk*. Swiss Finance Institute. Research Paper Series (pp. 20–42). Swiss Finance Institute. https://doi.org/10.2139/ssrn.3605155

Arif, M., Naeem, M. A., Hasan, M., Alawi, S. M., & Taghizadeh-Hesary, F. (2021). Pandemic crisis versus global financial crisis: Are Islamic stocks a safe-haven for G7 markets? *Economic Research-Ekonomska Istraživanja*. https://doi.org/10.1080/1331677X.2021.1910532

Aslam, F., Aziz, S., Nguyen, D. K., Mughal, K. S., & Khan, M. (2020). On the efficiency of foreign exchange markets in times of the COVID-19 pandemic. *Technological Forecasting and Social Change*, *161*, 120261. https://doi.org/10.1016/j.techfore.2020.120261

Aslam, F., Mohti, W., & Ferreira, P. (2020). Evidence of intraday multifractality in European stock markets during the recent coronavirus (COVID-19) outbreak. *International Journal of Financial Studies*, *8*(2), 31. https://doi.org/10.3390/ijfs8020031

Bai, L., Wei, Y., Wei, G., Li, X., & Zhang, S. (2021). Infectious disease pandemic and permanent volatility of international stock markets: A long-term perspective. *Finance Research Letters*, *40*, 101709. https://doi.org/10.1016/j.frl.2020.101709

Baker, M., & Wurgler, J. (2012). Comovement and predictability relationships between bonds and the cross-section of stocks. *Review of Asset Pricing Studies*, *2*(1), 57–87. https://doi.org/10.1093/rapstu/ras002

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*. NBER, w26945. https://doi.org/10.3386/w26945

Baldacci, E., & Kumar, M. (2010). *Fiscal deficits, public debt and sovereign bond yields*. IMF Working Paper, WP/10/184. Washington: International Monetary Fund. https://doi.org/10.5089/9781455202188.001

Bansal, T. (2020). *Behavioral finance and COVID-19: Cognitive errors that determine the financial future*. https://doi.org/10.2139/ssrn.3595749

Batool, M., Ghulam, H., Hayat, M. A., Naeem, M. Z., Ejaz, A., Imran, Z. A., Spulbar, C., & Gorun, T. H. (2020). How COVID-19 has shaken the sharing economy? An analysis using Google trends data. *Economic Research-Ekonomska Istraživanja*. https://doi.org/10.1080/1331677X.2020.1863830

Bi, H., & Marsh, W. B. (2020, December 7). *Flight to liquidity or safety? Recent evidence from the municipal bond market*. Federal Reserve Bank of Kansas City Working Paper (20-19).

Boettke, P., & Powell, B. (2021). The political economy of the COVID-19 pandemic. *Southern Economic Journal*, *87*(4), 1090–1017. https://doi.org/10.1002/soej.12488

Bordo, M. D., & Duca, J. V. (2021). *How the new fed municipal bond facility capped muni-treasury yield spreads in the COVID-19 recession*. NBER, w28437. https://doi.org/10.3386/w28437

Bordon, I. G., Schmid, K. D., & Schmidt, M. (2014). *Hypnosis before wake-up call? The revival of sovereign credit risk perception in the EMU-crisis* (No. 138). IMK Working Paper.

Breitung, J., & Das, S. (2005). Panel unit root tests under cross-sectional dependence. *Statistica Neerlandica*, *59*(4), 414–433. https://doi.org/10.1111/j.1467-9574.2005.00299.x

Butler, A. W., & Fauver, L. (2006). Institutional environment and sovereign credit ratings. *Financial Management*, *35*(3), 53–79. https://doi.org/10.1111/j.1755-053X.2006.tb00147.x

Cevik, S., & Öztürkkal, B. (2020). *Contagion of fear: Is the impact of COVID-19 on sovereign risk really indiscriminate?* IMF Working Paper 20/263. International Monetary Fund.

Chang, C.-L., McAleer, M., & Wong, W.-K. (2020). Risk and financial management of COVID-19 in business, economics and finance. *Journal of Risk and Financial Management*, *13*(5), 102. https://doi.org/10.3390/jrfm13050102

Chen, C., Liu, L., & Zhao, N. (2020). Fear sentiment, uncertainty, and bitcoin price dynamics: The case of COVID-19. *Emerging Markets Finance and Trade*, *56*(10), 2298–2309. https://doi.org/10.1080/1540496X.2020.1787150

Christensen, J. H., Fischer, E., & Shultz, P. (2020). Emerging bond markets and COVID-19: Evidence from Mexico. *FRBSF Economic Letter, Federal Reserve Bank of San Francisco*, *2020*(23), 1–5.

Cipriani, M., Haughwout, A. F., Hyman, B., Kovner, A., La Spada, G., Lieber, M., & Nee, S. (2020). *Municipal debt markets and the COVID-19 pandemic*. Federal Reserve Bank of New York, 20200629.

Cole, J., & Dodds, K. (2021). Unhealthy geopolitics: Can the response to COVID-19 reform climate change policy? *Bulletin of the World Health Organization*, *99*(2), 148–154. https://doi.org/10.2471/BLT.20.269068

Conlon, T., Corbet, S., & McGee, R. J. (2020). Are cryptocurrencies a safe haven for equity markets? An international perspective from the COVID-19 pandemic. *Research in International Business and Finance*, *54*, 101248. https://doi.org/10.1016/j.ribaf.2020.101248

Da, Z., Engelberg, J., & Gao, P. (2015). The sum of all FEARS investor sentiment and asset prices. *The Review of Financial Studies*, *28*(1), 1–32. https://doi.org/10.1093/rfs/hhu072

Enders, W. (2004). *Cointegration and error-correction models. Applied econometrics time series* (2nd ed.). Wiley.

Ettmeier, S., Kim, C. H., & Kriwoluzky, A. (2020). Financial market participants expect the Coronavirus pandemic to have long-lasting economic impact in Europe. *DIW Weekly Report*, *10*(19/20), 243–250. https://doi.org/10.18723/diw_dwr:2020-19-1

Gao, X., Ren, Y., & Umar, M. (2021). To what extent does COVID-19 drive stock market volatility? A comparison between the U.S. and China. *Economic Research-Ekonomska Istraživanja*. https://doi.org/10.1080/1331677X.2021.1906730

Gherghina, Ș. C., Armeanu, D. Ș., & Joldeș, C. C. (2020). Stock market reactions to Covid-19 pandemic outbreak: Quantitative evidence from ARDL bounds tests and Granger causality analysis. *International Journal of Environmental Research and Public Health*, *17*(18), 6729. https://doi.org/10.3390/ijerph17186729

Grund, S. (2020). The quest for a European safe asset—A comparative legal analysis of sovereign bond-backed securities, E-bonds, purple bonds, and coronabonds. *Journal of Financial Regulation*, *6*(2), 233–269. https://doi.org/10.1093/jfr/fjaa009

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed). Prentice hall.

Hall, C. M., Scott, D., & Gössling, S. (2020). Pandemics, transformations and tourism: Be careful what you wish for. *Tourism Geographies*, *22*(3), 577–598. https://doi.org/10.1080/14616688.2020.1759131

Haroon, O., & Rizvi, S. A. R. (2020). COVID-19: Media coverage and financial markets behavior-A sectoral inquiry. *Journal of Behavioral and Experimental Finance*, *27*, 100343. https://doi.org/10.1016/j.jbef.2020.100343

Haugh, D., Ollivaud, P., & Turner, D. (2009). *What drives sovereign risk premiums?: An analysis of recent evidence from the euro area*. OCDE Economics Department Working Papers. https://doi.org/10.1787/18151973

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, *46*(6), 1251–1271. https://doi.org/10.2307/1913827

Heisbourg, F. (2020). From Wuhan to the world: How the pandemic will reshape geopolitics. *Survival*, *62*(3), 7–24. https://doi.org/10.1080/00396338.2020.1763608

Hlouskova, J., & Wagner, M. (2006). The performance of panel unit root and stationarity tests: Results from a large scale simulation study. *Econometric Reviews*, *25*(1), 85–116. https://doi.org/10.1080/07474930500545504

James, N., Menzies, M., & Chan, J. (2021). Changes to the extreme and erratic behaviour of cryptocurrencies during COVID-19. *Physica A*, *565*, 125581. https://doi.org/10.1016/j.physa.2020.125581

Laborda, R., & Olmo, J. (2014). Investor sentiment and bond risk premia. *Journal of Financial Markets*, *18*, 206–233. https://doi.org/10.1016/j.finmar.2013.05.008

Lahmiri, S., & Bekiros, S. (2020). Renyi entropy and mutual information measurement of market expectations and investor fear during the COVID-19 pandemic. *Chaos, Solitons, and Fractals*, *139*, 110084. https://doi.org/10.1016/j.chaos.2020.110084

Laing, T. (2020). The economic impact of the Coronavirus 2019 (Covid-2019): Implications for the mining industry. *The Extractive Industries and Society*, *7*(2), 580–582. https://doi.org/10.1016/j.exis.2020.04.003

Ludvigson, S. C., Ma, S., & Ng, S. (2020). *Covid-19 and the macroeconomic effects of costly disasters*. Covid Economics, NBER, w26987. https://doi.org/10.3386/w26987

Lyócsa, Š., Baumöhl, E., Výrost, T., & Molnár, P. (2020). Fear of the coronavirus and the stock markets. *Finance Research Letters*, *36*, 101735. https://doi.org/10.1016/j.frl.2020.101735

Mann, F. D., Krueger, R. F., & Vohs, K. D. (2020). Personal economic anxiety in response to COVID-19. *Personality and Individual Differences*, *167*, 110233. https://doi.org/10.1016/j.paid.2020.110233

Mensi, W., Sensoy, A., Vo, X. V., & Kang, S. H. (2020). Impact of COVID-19 outbreak on asymmetric multifractality of gold and oil prices. *Resources Policy*, *69*, 101829. https://doi.org/10.1016/j.resourpol.2020.101829

Mirza, N., Hasnaoui, J. A., Naqvi, B., & Rizvi, S. K. A. (2020). The impact of human capital efficiency on Latin American mutual funds during Covid-19 outbreak. *Swiss Journal of Economics and Statistics*, *156*(1), 16–17. https://doi.org/10.1186/s41937-020-00066-6

Mirza, N., Naqvi, B., Rahat, B., & Rizvi, S. K. A. (2020). Price reaction, volatility timing and funds' performance during Covid-19. *Finance Research Letters*, *36*, 101657. https://doi.org/10.1016/j.frl.2020.101657

Mirza, N., Rahat, B., Naqvi, B., & Rizvi, S. K. A. (2020). Impact of Covid-19 on corporate solvency and possible policy responses in the EU. *The Quarterly Review of Economics and Finance*. https://doi.org/10.1016/j.qref.2020.09.002

Montero, R. (2013). *Variables no Estacionarias y Cointegración. Documentos de Trabajo en Economía Aplicada*. Universidad de Granada.

Montes, G. C., & Costa, J. (2020). Effects of fiscal credibility on sovereign risk: Evidence using comprehensive credit rating measures. *International Journal of Emerging Markets*. https://doi.org/10.1108/IJOEM-06-2020-0697

Muldur, G. T., Kandir, S. Y., & Onal, Y. B. (2019). Investor sentiment and speculative bond yield spreads. *Foundations of Management*, *11*(1), 177–186. https://doi.org/10.2478/fman-2019-0015

Naeem, M. A., Hasan, M., Agyemang, A., Chowdhury, M. I. H., & Balli, F. (2021). Time-frequency dynamics between fear connectedness of stocks and alternative assets. *International. Journal of Finance & Economics*. https://doi.org/10.1002/ijfe.2532

Nayak, S. (2010). Investor sentiment and corporate bond yield spreads. *Review of Behavioral Finance*, *2*(2), 59–80. https://doi.org/10.1002/rbf.9

Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., Agha, M., & Agha, R. (2020a). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery (London, England)*, *78*, 185–193. https://doi.org/10.1016/j.ijsu.2020.04.018

Nicola, M., Sohrabi, C., Mathew, G., Kerwan, A., Al-Jabir, A., Griffin, M., Agha, M., & Agha, R. (2020b). Health policy and leadership models during the COVID-19 pandemic: A review. *International Journal of Surgery (London, England)*, *81*, 122–129. https://doi.org/10.1016/j.ijsu.2020.07.026

Nicomedes, C. J. C., & Avila, R. M. A. (2020). An analysis on the panic during COVID-19 pandemic through an online form. *Journal of Effective Disorders*, *276*, 14–22. https://doi.org/10.1016/j.jad.2020.06.046

Papadamou, S., Fassas, A. P., Kenourgios, D., & Dimitriou, D. (2021). Flight-to-quality between global stock and bond markets in the COVID era. *Finance Research Letters*, *38*, 101852. https://doi.org/10.1016/j.frl.2020.101852

Phan, D. H. B., & Narayan, P. K. (2020). Country responses and the reaction of the stock market to COVID-19—A preliminary exposition. *Emerging Markets Finance and Trade*, *56*(10), 2138–2150. https://doi.org/10.1080/1540496X.2020.1784719

Rizvi, S. K. A., Mirza, N., Naqvi, B., & Rahat, B. (2020). Covid-19 and asset management in EU: A preliminary assessment of performance and investment styles. *Journal of Asset Management*, *21*(4), 281–291. https://doi.org/10.1057/s41260-020-00172-3

Rizvi, S. K. A., Yarovaya, L., Mirza, N., Naqvi, B. (2020). *The impact of COVID-19 on valuations of non-financial European firms*. https://ssrn.com/abstract=3705462

Salgotra, R., Gandomi, M., & Gandomi, A. H. (2020). Evolutionary modelling of the COVID-19 pandemic in fifteen most affected countries. *Chaos, Solitons, and Fractals*, *140*, 110118. https://doi.org/10.1016/j.chaos.2020.110118

Salisu, A. A., & Akanni, L. O. (2020). Constructing a global fear index for the COVID-19 pandemic. *Emerging Markets Finance and Trade*, *56*(10), 2310–2331. https://doi.org/10.1080/1540496X.2020.1785424

Salisu, A. A., Akanni, L., & Raheem, I. (2020a). The COVID-19 global fear index and the predictability of commodity price returns. *Journal of Behavioral and Experimental Finance*, *27*, 100383. https://doi.org/10.1016/j.jbef.2020.100383

Salisu, A. A., Sikiru, A. A., & Vo, X. V. (2020b). Pandemics and the emerging stock markets. *Borsa Istanbul Review*, *20*(1), S40–S548. https://doi.org/10.1016/j.bir.2020.11.004

Samuel, J., Ali, G. G., Rahman, M., Esawi, E., & Samuel, Y. (2020). COVID-19 public sentiment insights and machine learning for tweets classification. *Information*, *11*(6), 314. https://doi.org/10.3390/info11060314

Sharif, A., Aloui, C., & Yarovaya, L. (2020). COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. *International Review of Financial Analysis*, *70*, 101496. https://doi.org/10.1016/j.irfa.2020.101496

Smales, L. A. (2016). Risk-on/risk-off: Financial market response to investor fear. *Finance Research Letters*, *17*, 125–134. https://doi.org/10.1016/j.frl.2016.03.010

Subramaniam, S., & Chakraborty, M. (2021). COVID-19 fear index: Does it matter for stock market returns? *Review of Behavioral Finance*, *13* (1), 40–50. https://doi.org/10.1108/RBF-08-2020-0215

Szmuda, T., Ali, S., Hetzger, T. V., Rosvall, P., & Słoniewski, P. (2020). Are online searches for the novel coronavirus (COVID-19) related to media or epidemiology? A cross-sectional study. *International Journal of Infectious Diseases: IJID: Official Publication of the International Society for Infectious Diseases*, *97*, 386–390. https://doi.org/10.1016/j.ijid.2020.06.028

Umar, Z., & Gubareva, M. (2020). A time-frequency analysis of the impact of the Covid-19 induced panic on the volatility of currency and cryptocurrency markets. *Journal of Behavioral and Experimental Finance*, *28*, 100404. https://doi.org/10.1016/j.jbef.2020.100404

van Barneveld, K., Quinlan, M., Kriesler, P., Junor, A., Baum, F., Chowdhury, A., Junankar, P. (R.), Clibborn, S., Flanagan, F., Wright, C. F., Friel, S., Halevi, J., & Rainnie, A. (2020). The COVID-19 pandemic: Lessons on building more equal and sustainable societies. *The Economic and Labour Relations Review*, *31*(2), 133–157. https://doi.org/10.1177/1035304620927107

Van Hoang, T. H., & Syed, Q. R. (2021). Investor sentiment and volatility prediction of currencies and commodities during the COVID-19 pandemic. *Asian Economics Letters*, *1*(4), 18642. https://doi.org/10.46557/001c.18642

Vasileiou, E. (2021). Behavioral finance and market efficiency in the time of the COVID-19 pandemic: Does fear drive the market? *International Review of Applied Economics*, *35*(2), 224–241. https://doi.org/10.1080/02692171.2020.1864301

Whaley, R. E. (2000). The investor fear gauge. *The Journal of Portfolio Management*, *26*(3), 12–17. https://doi.org/10.3905/jpm.2000.319728

Yarovaya, L., Mirza, N., Abaidi, J., & Hasnaoui, A. (2021). Human capital efficiency and equity funds' performance during the COVID-19 pandemic. *International Review of Economics & Finance*, *71*, 584–591. https://doi.org/10.1016/j.iref.2020.09.017

Yarovaya, L., Mirza, N., Rizvi, S. K. A., & Naqvi, B. (2020a). *COVID-19 pandemic and stress testing the eurozone credit portfolios*. https://ssrn.com/abstract=3705474

Yarovaya, L., Mirza, N., Rizvi, S. K. A., Saba, I., & Naqvi, B. (2020b). The resilience of Islamic equity funds during COVID-19: Evidence from risk adjusted performance, investment styles and volatility timing. *Investment Styles and Volatility Timing*. https://ssrn.com/abstract=3737689 or https://doi.org/10.2139/ssrn.3737689

Zaremba, A., Kizys, R., Aharon, D. Y., & Demir, E. (2020). Infected markets: Novel coronavirus, government interventions, and stock return volatility around the globe. *Finance Research Letters*, *35*, 101597 https://doi.org/10.1016/j.frl.2020.101597

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

Zhu, S., Liu, Q., Wang, Y., Wei, Y., & Wei, G. (2019). Which fear index matters for predicting US stock market volatilities: Text-counts or option based measurement? *Physica A: Statistical Mechanics and ts Applications*, *536*, 122567. https://doi.org/10.1016/j.physa.2019.122567