Assistant Professor Coşkun AKDENİZ, PhD (Corresponding author)
Tekirdağ Namık Kemal University, Department of Economics,
Tekirdağ, Turkey
E-mail: cakdeniz@nku.edu.tr
Professor Abdurrahman Nazif ÇATIK, PhD
Ege University, Department of Economics, İzmir, Turkey
E-mail: a.nazif.catik@ege.edu.tr
Assistant Professor Gül Huyugüzel KIŞLA, PhD
Ege University, Department of Economics, İzmir, Turkey
E-mail: gul.kisla@ege.edu.tr

THE IMPACT OF OIL PRICES ON OIL-GAS STOCK RETURNS: A FRESH EVIDENCE FROM THE COVID-AFFECTED COUNTRIES

Abstract. *The effects of oil price exposure of oil-gas sectors of the countries largely affected by Covid-19 is analyzed with a time-varying parameter model. Estimation results suggest that market risk of all countries' oil-gas sector excluding China has increased remarkably compared to the period before the spread of the virus. Positive and significant effects of the oil price factor become negative and significant for most countries during the pandemic. The results further indicate that the oil-gas sector of China is not affected by the outbreak of Covid-19, even though the virus has first appeared in that country.*

Keywords: *Covid-19, Oil-gas sector, Time-varying parameter, asset-pricing.*
JEL Classification: G12, C5, C58

1. Introduction

Since the first case of the COVID-19 virus was announced in Wuhan, China, the countries have been struggling with health issues. As with the rapid spread of the virus from China to the rest of the world, the authorities have undertaken serious mitigation measures, including the closures of schools and public places, transportation restrictions, and imposition of curfew in densely populated cities. Those measures have led to serious contractions in the economic and financial activities and trigger a substantial decline in the demand for all commodities. Compared to others, the oil market turns out to be the most adversely affected market by the pandemic due to the decline in fuel demand because of the widespread suspension of local and global travel activities. World Bank (2020) reported that oil demand fell by 6 percent in the first quarter of the year, and it will be expected to fall by 23 percent in the second quarter because of transportation disruptions. International Energy Agency (2020) has also

DOI: 10.24818/18423264/55.3.21.14

predicted that global oil demand is expected to decrease by about 10 percent in 2020 due to COVID-19. In addition to a decline in global demand, the crisis in the oil market has been deepened with the disagreement between OPEC and their partner countries on the production cuts. As a result of the developments mentioned above, crude oil spot prices had decreased from the level of 60 U.S. dollars in December 2019 to around 15 U.S. dollars in May 2020. In terms of the impact of the pandemic on the stock markets, it is observed that contraction in oil demand and decrease in market prices has led to the substantial decline in the returns of oil-gas companies by more than the overall market.[1]

Despite the abundant number of studies concentrating on the impacts of various factors on the stock markets, analysis of the effects of infectious diseases on the stock markets has remained very limited. For instance, Nippani and Washer (2004), Loh (2006), and Chen et al. (2007) examine the effects of SARS, and Del Giudice and Paltrinieri (2017) examine the effects of Ebola on the stock markets of the different countries.[2] Nippani and Washer (2004) investigate the impact of the SARS pandemic on the stock market of Canada, China, Hong Kong, Indonesia, Philippines, Singapore, Thailand, and Vietnam. The possible changes in stocks for pre-pandemic and pandemic periods are examined with t-tests and the non-parametric Mann-Whitney test. The findings reveal that SARS does not affect the countries' stock exchanges except for China and Vietnam. The effects of the SARS have also been investigated by Loh (2006) by focusing on the stock returns of airline firms in Canada, China, Singapore, and Thailand. The systematic risk components calculated through the least-squares method imply that the SARS pandemic does not significantly affect the airline industries of the countries under consideration. Chen et al. (2007) examine the effects of SARS on the Taiwanese sectoral stock returns based on the estimation of various GARCH specifications. The results indicate that pandemic has a negative effect on Taiwan hospitality stock returns, and sudden and negative reactions have also been observed after the outbreak in the different segments of the tourism sector. Del Giudice and Paltrinieri (2017) investigate the effects of the Ebola virus and the Arab Spring and find negative and significant effects of those events on mutual funds.

A limited number of studies have recently analyzed the impact of the COVID-19 on the stock markets, e.g., Liu et al. (2020), Sharif et al. (2020), Corbet et al. (2020), and Conlon and McGee (2020). They are mainly concentrated on the effects of a pandemic on the aggregate stock returns. For example, Liu et al. (2020) discuss the

[1] As the most affected country by the pandemic, U.S. oil-gas sectoral stock returns has been declined by about 29.99 percent between January 1st and May 20th, whereas S&P 500 share prices has declined by about 8.02 percent on that time.

[2] For a detailed literature on the global impact of pandemics, please see Liu et al. (2020) and Goodell (2020).

correlations between stock indices and COVID-19 in twenty-one countries, including Japan, Korea, Singapore, the U.S., Germany, Italy, and the U.K. Based on the daily data covering the period from February, 21 2019 to March, 18 2020, an event study has been conducted by calculating abnormal returns. The results indicate the presence of sudden drops in the stock market returns of the countries. Furthermore, it is observed that negative abnormal returns in Asian countries are more pronounced compared to other countries in the sample. It is also evidenced that stock market returns are negatively affected by confirmed COVID-19 cases. Sharif et al. (2020) analyze the correlation between the COVID-19 pandemic and oil price volatility shock, stock market, geopolitical risks, and economic policy uncertainties in the United States based on a time-frequency approach. The evidence-based wavelet method covering the period from January, 21 2020 to March, 30 2020 shows that the effect of the COVID-19 pandemic on the U.S. geopolitical risk is higher than the U.S.'s economic uncertainty. Strong connections at low frequencies also indicate that COVID-19 is expected to have a long-term negative impact on geopolitical risk levels and economic uncertainty. Furthermore, the collapse in oil prices has a stronger effect on the U.S. stock exchange when compared to COVID-19, geopolitical and uncertainty risks. Corbet et al. (2020) examine the impact of Coronavirus on Chinese stock markets by utilizing GARCH models. In addition to the Shanghai and Shenzhen stock returns, the U.S. stock returns, oil, gold, and Bitcoin prices are employed in the study. The findings reveal that the correlation between the Chinese stock exchange and Bitcoin volatilities has improved significantly during periods of financial pressure. It is found that COVID-19 has a strong and significant effect on volatilities in both Shanghai and Shenzhen stock exchanges. Conlon and McGee (2020) employed the Value at Risk models to analyze the downside risk reduction in three cryptocurrencies (Bitcoin, Ether, and Tether) during the COVID-19 crisis. The study uses the stock market returns of countries seriously affected by COVID-19, i.e., the U.S., the U.K., Italy, Spain, and China, as well as the cryptocurrencies Bitcoin and Ethereum. The results imply that those cryptocurrencies may not be considered safe investment havens in most analyzed stock markets. However, since Tether successfully preserved its value against the dollar during the COVID-19 pandemic, it could be regarded as a safe investment haven among the alternative assets under consideration.

The main objective of this article is to assess whether the outbreak of COVID-19 has a significant impact on the oil-gas sector stock returns of the countries largely influenced by the virus. Instead of working on the effects of a pandemic on the aggregate level, we select the oil-gas sector because it is accepted as one of the key sectors located at the center of the production network of the economies (Tran et al., 2017). Furthermore, it is observed that the studies have investigated the financial

effects of COVID-19 via constant coefficient models. To fill this gap in the literature, this article estimates an asset-pricing model with a time-varying parameter model based on the Kalman filter to compare the influence of the factors affecting the oil-gas sector before and after the outbreak COVID-19.

The remainder of the article is structured as follows. Data and methodology are described in the next section. Section three summarizes the empirical findings on the oil-gas sector of the selected countries. Finally, the paper ends with the concluding remarks.

2. Data and Methodology

2.1. Data

This article investigates the risk factors, such as market risk, oil price, and exchange rate, that affect the oil-gas sector returns of the six countries impacted by the COVID-19 pandemic: U.S., U.K., Italy, France, Spain, and China.[3] The analysis is based on daily data covering the period from August 9, 2001 to May 20, 2020 collected through the database of Thomson Reuters Datastream. As for the market risk aggregate stock market returns of each country are employed. As an indicator of world oil price Brent crude oil price in U.S. dollar per barrel is used. The exchange rate is included as an additional risk factor in the asset-pricing model since a change in the value of the domestic currency may have important implications on the competitiveness of energy companies, as evidenced by previous studies (Boyer and Filion 2007; Bianconi and Yoshino 2014).[4] The effects of risk factors on the stock prices have been defined in terms of excess returns of the variables in asset-pricing models. Therefore, excess returns are computed by subtracting the risk-free interest rate from the daily returns of each variable.[5]

The descriptive statistics of the excess returns are presented in Table 1, in which the behavior of the asset returns for the period before and after an outbreak of COVID-19 has been compared. The mean value of the excess returns of the oil-gas sector is very close to zero before the pandemic, generally turn negative after the virus outbreak. The decline in the mean value of excess returns is very notable, especially in Italy, the United Kingdom, and Spain. Similar to the oil-gas sector, market returns of all countries decline significantly; negative market returns have been reported during the period of pandemics except for China. Among the variables in the asset-pricing

[3] We select the top five countries with the highest reported number of total number of deaths due to COVID-19 at end of the analysis period, May 20, 2020. We also include China since it is the country where the virus is originated from.

[4] For the countries except for U.S., national currency to US dollar exchange rate is used. For U.S., we use US dollar to Euro exchange rate.

[5] We use deposit overnight rate as a proxy for the risk-free rate of return, since treasury bill rate is not available at daily frequency.

model, the highest fall during the COVID-19 has been detected in the oil price returns. At that time, suspension of all travel activities leads to a fall in oil demand, which triggers a substantial decline in oil prices. The results presented in Table 1 indicate a considerable increase in the volatility across oil-gas sectors of the economies.

Table 1: Descriptives of the variables before and after COVID-19[1]

Before COVID-19						
Country	**Variables**	**Mean (x10^5)**	**Max.**	**Min.**	**Std. Dev.**	**Jarque-Bera**
U.S.	$Roil_t$	18.000	0.000	-0.150	0.014	31239.660
	$Rmrkt_t$	21.500	0.109	-0.094	0.011	21212.620
	$Rpoil_t$	19.200	0.181	-0.198	0.021	6645.477
	Rer_t	4.880	0.046	-0.038	0.005	1822.944
U.K.	$Roil_t$	-3.950	0.111	-0.087	0.014	4624.854
	$Rmrkt_t$	0.282	0.093	-0.092	0.011	11164.890
	$Rpoil_t$	10.900	0.181	-0.199	0.021	6643.008
	Rer_t	-4.330	0.082	-0.044	0.005	27122.820
Italy	$Roil_t$	-4.770	0.159	-0.102	0.016	14935.920
	$Rmrkt_t$	-12.400	0.108	-0.133	0.014	6279.242
	$Rpoil_t$	13.400	0.181	-0.199	0.021	6642.396
	Rer_t	-8.27	0.038	-0.046	0.005	1918.215
France	$Roil_t$	3.650	0.125	-0.094	0.015	6450.396
	$Rmrkt_t$	3.930	0.105	-0.094	0.013	7138.282
	$Rpoil_t$	17.400	0.181	-0.198	0.021	6633.291
	Rer_t	-4.770	0.038	-0.046	0.005	1917.978
Spain	$Roil_t$	1.840	0.108	-0.135	0.016	7397.932
	$Rmrkt_t$	-1.070	0.134	-0.131	0.014	10257.770
	$Rpoil_t$	13.400	0.181	-0.199	0.021	6642.395
	Rer_t	-8.270	0.038	-0.046	0.005	1918.215
China	$Roil_t$	-0.6170	0.096	-0.236	0.018	24044.770
	$Rmrkt_t$	6.160	0.093	-0.092	0.015	5738.146
	$Rpoil_t$	16.800	0.181	-0.198	0.021	6597.601
	Rer_t	-5.990	0.018	-0.020	0.001	156790.100
COVID-19						
Country	**Variables**	**Mean (x10^5)**	**Max.**	**Min.**	**Std. Dev.**	**Jarque-Bera**
U.S.	$Roil_t$	-380.700	0.157	-0.164	0.048	31.701
	$Rmrkt_t$	-130.800	0.089	-0.127	0.033	28.281
	$Rpoil_t$	-762.200	0.412	-0.643	0.118	391.899
	Rer_t	-9.370	0.017	-0.017	0.005	4.952
U.K.	$Roil_t$	-532.500	0.195	-0.204	0.053	57.882
	$Rmrkt_t$	-249.7	0.086	-0.115	0.027	48.433
	$Rpoil_t$	-697.600	0.412	-0.643	0.124	283.312
	Rer_t	81.400	0.027	-0.031	0.009	14.873
Italy	$Roil_t$	-540.100	0.139	-0.233	0.048	267.484
	$Rmrkt_t$	-408.000	0.085	-0.185	0.034	375.792
	$Rpoil_t$	-695.100	0.412	-0.643	0.124	283.344
	Rer_t	6.170	0.017	-0.017	0.006	4.806
France	$Roil_t$	-422.5	0.139	-0.181	0.047	60.678

	$Rmrkt_t$	-352.3	0.080	-0.130	0.030	56.154
	$Rpoil_t$	-696.1	0.412	-0.643	0.121	335.925
	Rer_t	3.580	0.017	-0.017	0.005	6.518
Spain	$Roil_t$	-460.200	0.145	-0.163	0.047	23.798
	$Rmrkt_t$	-441.000	0.075	-0.151	0.031	135.879
	$Rpoil_t$	-695.100	0.412	-0.643	0.124	283.344
	Rer_t	6.170	0.017	-0.017	0.006	4.806
China	$Roil_t$	-162.300	0.036	-0.085	0.012	1331.790
	$Rmrkt_t$	1.390	0.030	-0.080	0.013	629.977
	$Rpoil_t$	-539.700	0.412	-0.643	0.100	1250.493
	Rer_t	700.04	0.013	-0.006	0.002	132.7612

Note: This table displays the descriptive statistics for the variables utilized in the econometric analysis. The first confirmed case of Coronavirus in China is announced on December 1, 2019. U.S. and France announced the first cases on January 21, 2020 and January 24, 2020 respectively. On the other hand, U.K., Italy, and Spain declared the first case of Coronavirus on January 31, 2020.

2.2. Methodology

The following model is estimated to analyze the asset-pricing behavior of the oil-gas sector:

$$Roil_t = \alpha_t + \beta^m Rmrkt_t + \sum_{j=0}^{n} \beta_j^{poil} Rpoil_{t-j} + \sum_{j=0}^{n} \beta_j^{er} Rer_{t-j} + u_t \quad (1)$$

where $Roil_t$ represents excess returns in the oil-gas sector of each country. $Rmrkt_t$, $Rpoil_t$ and Rer_t denote the respective returns on the market, oil prices, and exchange rates. The coefficient on market return β^m known as market beta, compares the risk of the oil-gas sector concerning the overall market portfolio. Besides, the possible lagged effects of oil price and exchange rate factors have been accounted for by introducing up to five lags of oil price and exchange rate return variables to the model (Jones and Kaul, 1996; McSweeney and Worthington, 2008; Moya-Martinez et al., 2014). Finally, β_j^{poil} and β_j^{er} represent the coefficients of level and lags of oil price and exchange rate returns.

Those as mentioned above linear asset-pricing model is converted into a time-varying state-space model composed of the following equations system:

$$Roil_t = \alpha_t + \beta_t^m Rmrkt_t + \sum_{j=0}^{p} \beta_t^{poil} Rpoil_t + \sum_{j=0}^{p} \beta_t^{er} Rer_t + u_t \qquad u_t \sim nid(0, \sigma_{u.t}^2) \quad (2)$$

$$\alpha_t = \alpha_{t-1} + \vartheta_t^{\alpha} \qquad \vartheta_t^{\alpha} \sim iid(0, \sigma_{\alpha.t}^2) \quad (3)$$

$$\beta_t^m = \beta_{t-1}^m + \vartheta_t^m \qquad \vartheta_t^m \sim iid(0, \sigma_{vm.t}^2) \quad (4)$$

$$\beta_{j.t}^{poil} = \beta_{j.t-1}^{poil} + \vartheta_{j.t}^{poil} \qquad \vartheta_{j.t}^{poil} \sim iid\left(0, \sigma_{poil.j.t}^2\right) \quad (5)$$

$$\beta_{j.t}^{er} = \beta_{j.t-1}^{er} + \vartheta_{j.t}^{er} \qquad \vartheta_{j.t}^{er} \sim iid\left(0, \sigma_{er.j.t}^2\right) \quad (6)$$

The model presented in equation (2) is known as observation or measurement equation, whereas equations from (3) to (6), known as state or transition equations, are used to specify the law of motion of the time-varying parameters. The coefficients of

the time-varying parameters and their variances are known as hyperparameters. This article assumes that the parameters in the measurement equation vary over time by following a random walk without intercept process, which is comparable to previous research on the asset-pricing model. It is also common practice to assume that the error terms of state equations are independently and identically distributed, with a zero mean and constant variance. The model given above is calculated with maximum likelihood using the Kalman (1960) filter.[6]

3. Empirical Results

In this section, the linear form of the asset-pricing models of the countries are first estimated through Ordinary Least Square (OLS) (see Table 2). The first thing worth mentioning is that the overall impact of oil price returns is found to be significant and positive for all countries in the estimation sample. Except for the U.K., the coefficient on market return measuring systematic risk is estimated as less than unity. This can be taken as evidence that the oil-gas sector can be considered as a less risky sector concerning the overall market except for the U.K. The highest impact of the oil prices on the oil-gas sectoral stock returns is observed in Spain, while the lowest impact is evidenced in China. Similarly, the OLS results reveal that the oil-gas sectors of each country are significantly and positively affected by fluctuations in the exchange rates. In particular, the highest impact of the exchange rate returns is observed in the U.K., and the lowest impact of the exchange rate returns is reported for China.

Table 2: OLS estimation of the asset-pricing model

Variables	U.S.	U.K.	Italy	France	Spain	China
c_t	-0.000	-0.000	0.000	-0.000	0.000	-0.000
$Rmrkt_t$	0.966***	1.027***	0.840***	0.883***	0.823***	0.888***
$Roil_t$	0.113***	0.124***	0.114***	0.119***	0.115***	0.005
$Roil_{t-1}$	-0.004	0.004	0.001	0.001	0.031***	0.022***
$Roil_{t-2}$	-0.012**	-0.016**	-0.017**	-0.014***	-0.010*	-0.012*
$Roil_{t-3}$	0.005	0.006	0.008	0.000	0.002	-0.003
$Roil_{t-4}$	-0.001	-0.007	0.002	-0.001	0.004	0.003
$Roil_{t-5}$	0.002	-0.006	-0.004	0.001	0.009	0.007
Rer_t	0.096***	0.192***	0.011	0.027	0.029	0.248*
Rer_{t-1}	0.000	0.035	0.059**	0.021	0.054*	-0.222*
Rer_{t-2}	-0.041*	-0.035	0.020	-0.001	-0.040	0.013
Rer_{t-3}	-0.003	0.020	0.008	-0.009	0.001	0.081
Rer_{t-4}	-0.011	0.000	0.012	0.022	0.081***	0.046
Rer_{t-5}	-0.022	0.041*	0.052*	0.038***	0.030	0.098
R^2	0.651	0.668	0.670	0.691	0.565	0.533

[6] Kim and Nelson (1999) and Commandeur and Koopman (2007) have described the detailed estimation stages of Kalman filtering.

Note: The table represents the OLS regression results of the multifactor linear model for all countries. Newey-West procedure is used for the correction of the autocorrelation and heteroscedasticity problem, which might be observed in the standard errors of the coefficients. The sign of *,**, and *** show the statistical significance at the level of 10%, 5%, and 1%, respectively.

The time-varying parameter model presented in equations (2)-(6) is estimated to examine risk variables influencing each country's oil and gas sectors.[7] The time-varying parameters are shown with their two standard error confidence bands to evaluate their significance over time.[8] First, the time-varying market beta coefficients of oil-gas sectors are reported in Figure 1.

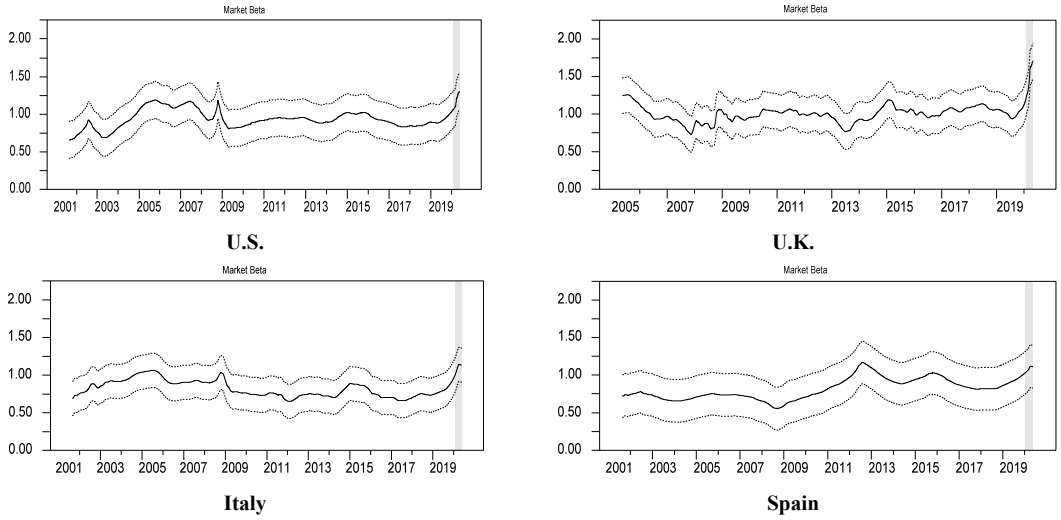
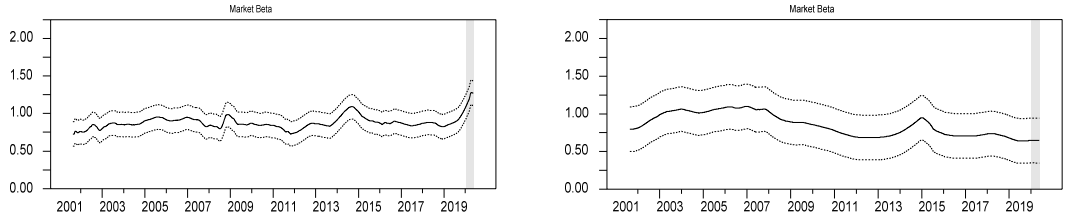


Figure 1.: Market beta coefficients

[7] Before the time-varying estimates, the stability of the linear asset-pricing model has been investigated with recursive residuals and sequential F tests. The results imply that the parameter instabilities in the oil-gas sectors seem to have coincided with 2008 global financial crisis and the recent fluctuations in the oil market. Sequential F test results imply that the oil-gas sector of all countries except for China has significantly been affected by the plunge in oil prices associated with the outbreak of the virus. The stability test results are not reported in the paper but available upon request from the corresponding author.

[8] It can be concluded that the time-varying parameter is significantly different from zero if the upper and lower error bands of time-varying coefficients illustrated by two dashed lines do not contain the value of zero. Otherwise, the coefficient is not significant if the standard error band includes the zero value.



France **China**

Figure 1. (continued): Market beta coefficients

Note: Shaded area corresponds to the outbreak period of COVID-19 for each country.

Market risk of all countries is found to be significant throughout the analysis period; hikes in the market risk become more evident during the 2008 Global financial crisis and after the outbreak of the Coronavirus. Descriptive statistics of the parameters are presented in Table 3.

Table 3: Descriptive statistics of the parameters

Before COVID-19							
Countries	**Series**	**Mean**	**Std. Error**	**Min.**		**Max.**	
U.S.	$\beta_{m,t}$	0.934	0.119	0.661	2001:08:15	1.190	---
	$\beta_{oil,t}$	0.148	0.079	-0.066	---	0.333	2018:03:23
	$\beta_{er,t}$	0.085	0.152	-0.455	2008:10:15	0.350	2006:11:28
U.K.	$\beta_{m,t}$	0.997	0.084	0.744	2001:08:16	1.281	---
	$\beta_{oil,t}$	0.163	0.084	-0.065	---	0.352	2016:09:29
	$\beta_{er,t}$	0.224	0.194	-0.172	2011:01:04	0.702	2007:10:12
Italy	$\beta_{m,t}$	0.821	0.108	0.652	2012:02:07	1.063	---
	$\beta_{oil,t}$	0.173	0.070	-0.046	---	0.290	2007:11:12
	$\beta_{er,t}$	0.139	0.187	-0.241	---	0.557	2008:10:28
Spain	$\beta_{m,t}$	0.816	0.138	0.555	2008:09:19	1.169	2012:08:06
	$\beta_{oil,t}$	0.203	0.077	0.047	---	0.368	2012:04:17
	$\beta_{er,t}$	0.120	0.230	-0.930	---	0.581	2002:07:22
France	$\beta_{m,t}$	0.873	0.068	0.726	2011:11:01	1.102	---
	$\beta_{oil,t}$	0.175	0.067	-0.021	---	0.318	2007:11:12
	$\beta_{er,t}$	0.057	0.174	-0.486	---	0.477	2008:10:28
China	$\beta_{m,t}$	0.855	0.147	0.641	2019:08:30	1.098	2007:01:09
	$\beta_{oil,t}$	0.044	0.052	-0.039	2005:06:09	0.136	2017:11:23
	$\beta_{er,t}$	-0.063	0.480	-0.916	2005:07:22	0.848	2016:01:08
COVID-19							
U.S.	$\beta_{m,t}$	1.172	0.091	1.054	---	1.303	2020:05:20
	$\beta_{oil,t}$	0.064	0.103	-0.091	2020:04:21	0.180	---
	$\beta_{er,t}$	0.060	0.030	0.024	---	0.123	---
U.K.	$\beta_{m,t}$	1.528	0.141	1.286	---	1.675	2020:05:20
	$\beta_{oil,t}$	-0.048	0.103	-0.219	2020:03:31	0.090	---
	$\beta_{er,t}$	0.295	0.084	0.088	---	0.391	---

Italy	$\beta_{m,t}$	1.108	0.041	1.013	----	1.144	2020:03:31
	$\beta_{oil,t}$	-0.018	0.072	-0.152	2020:03:31	0.089	---
	$\beta_{er,t}$	0.528	0.075	0.370	2020:04:03	0.653	---
Spain	$\beta_{m,t}$	1.088	0.029	1.038	---	1.119	---
	$\beta_{oil,t}$	0.045	0.052	-0.066	2020:03:31	0.101	---
	$\beta_{er,t}$	-1.075	0.080	-1.223	2020:03:31	-0.934	---
France	$\beta_{m,t}$	1.215	0.061	1.105	---	1.279	2020:04:21
	$\beta_{oil,t}$	-0.029	0.123	-0.276	2020:03:31	0.118	---
	$\beta_{er,t}$	-0.541	0.095	-0.778	2020:04:03	-0.438	---
China	$\beta_{m,t}$	0.645	0.001	0.644	---	0.647	---
	$\beta_{oil,t}$	0.023	0.008	0.015	---	0.039	---
	$\beta_{er,t}$	-0.455	0.071	-0.525	---	-0.303	---

Note: This table shows the descriptive properties of the time-varying parameters considering the pre-COVID-19 period and COVID-19 period.

In particular, the risk level of oil-gas sectors of the U.S., U.K., Italy, and France have reached their peak value during the period of the pandemic. Among those countries, the highest market risk factor has been estimated for the U.K. with 1.675 on May 20, 2020. An increase in the market beta of Spain throughout the pandemic is also worth mentioning. However, the market risk in that country has achieved its maximum on August 6, 2012, which may be explained by the European debt crisis that occurred at that time. In contrast with the countries mentioned earlier, oil-gas stock returns of the Chinese companies have remained below the overall market over the pandemic period.

The time-varying parameters reflecting contemporaneous and cumulative impacts of oil price and exchange are factors are plotted in Figures 2 and 3, respectively. Cumulative time-varying parameters are also plotted in panel (c) of the figures from January 1, 2019 to capture the evolution of the effects of risk factors before and after the outbreak of COVID-19. The results, in general, suggest that except for China, oil prices have a positive effect on the stock returns of oil-gas companies. Oil prices have a positive impact on the stock returns of U.S. companies in the majority of the investigation period; however, this figure becomes negative and insignificant after March, 2020 associated with the substantial decline in oil prices. The positive effect of oil price returns is also reported for the oil-gas sector of the U.K.; the impact of oil price risk turns negative and significant by the end of March, 2020. The effects of oil prices in Italy and Spain are very similar to that of the U.K. negative. A significant impact of oil prices has also been reported on a time when a great plunge in oil prices has been experienced due to Coronavirus. The impact of oil prices on China's oil-gas stock returns is found to be low and generally insignificant throughout the estimated period, including the COVID-19 period, similar to the findings of market beta coefficients.

Time-varying parameter estimates for exchange rate parameters reported in Figure 3 indicate that exchange rate exposure of the oil-gas sector is less significant than oil prices for all countries. It is also notable that the impact of exchange rate returns differs markedly across time and countries in contrast with the general evidence on the positive impact of oil price returns. For the U.S. and U.K., the impact of the exchange rate is mostly positive; during the period of the COVID-19 pandemic, no significant effect of the exchange rate has been observed in both countries. France and Spain seem to be unaffected by the exchange rate; however, the negative and significant impact of exchange rate fluctuations becomes more apparent by the midst of 2019. The largest negative effect of exchange rate risk has coincided with the time of plunge in oil prices.

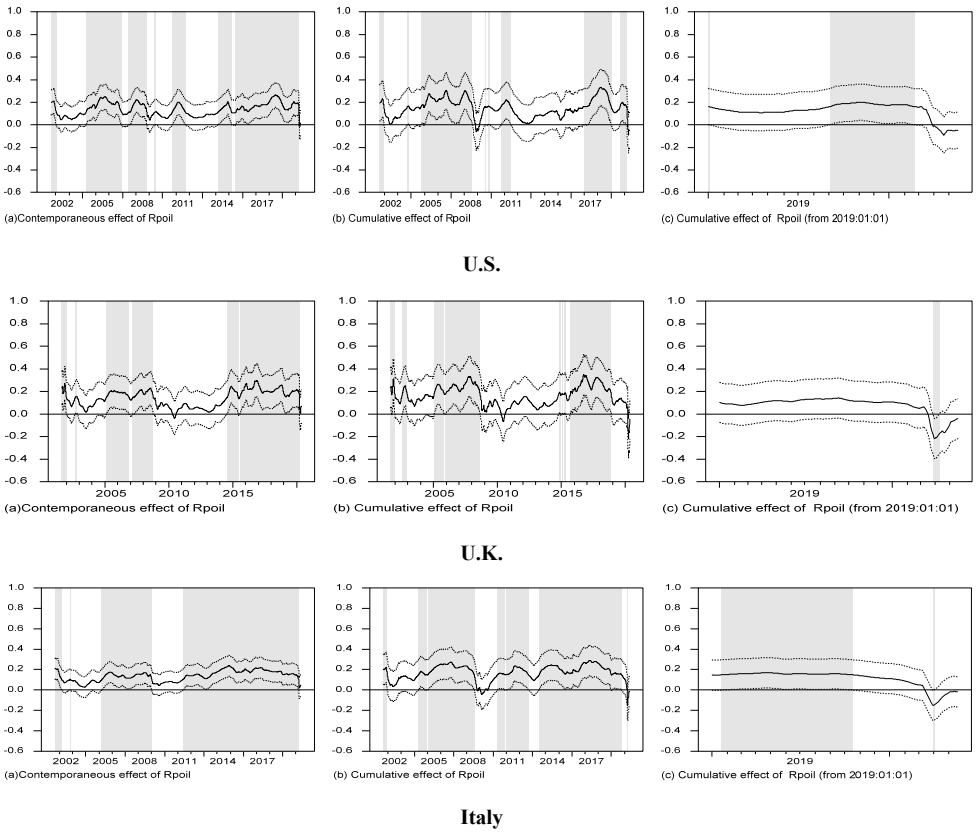
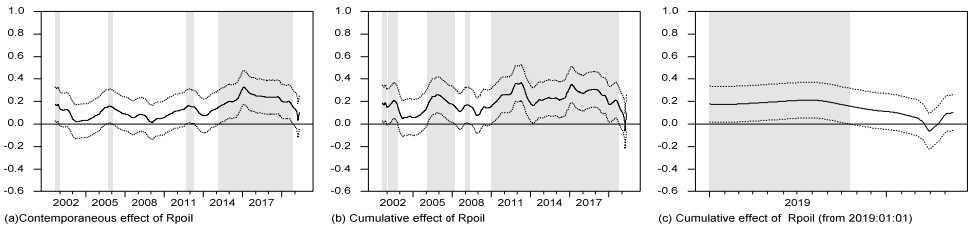
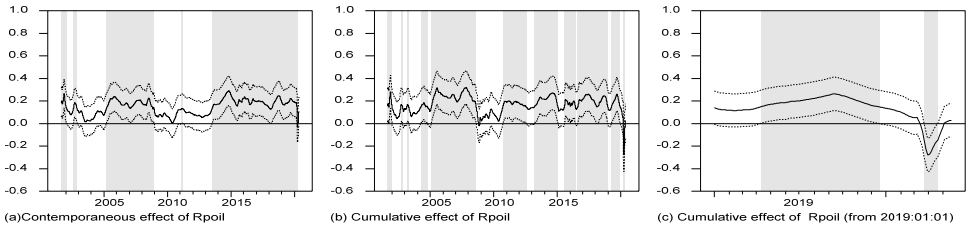


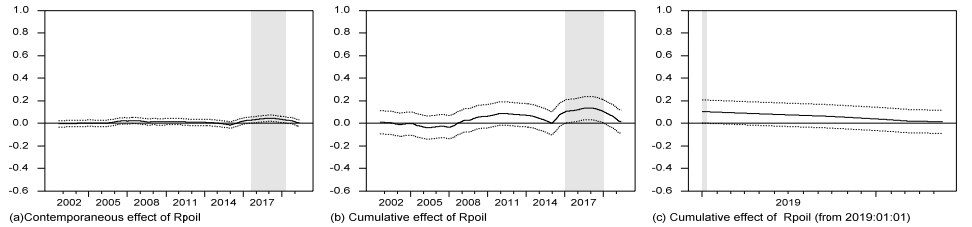
Figure 2.: Time-varying oil price parameters



Spain



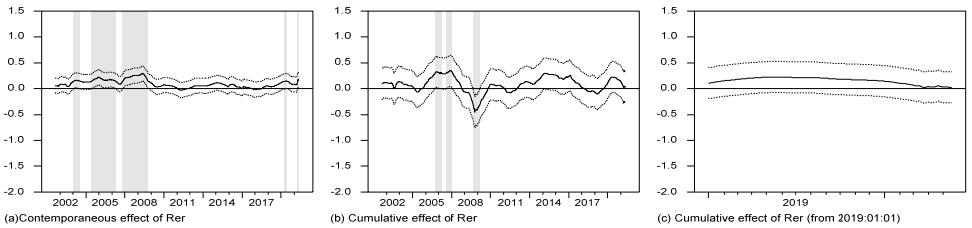
France



China

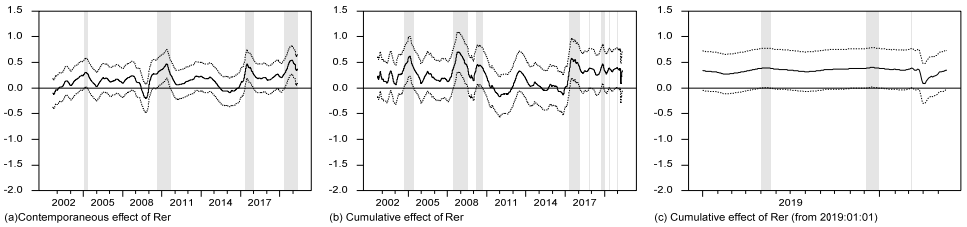
Figure 2. (continued): Time-varying oil price parameters

Note: Shaded areas show the intervals where time-varying coefficients are significant.

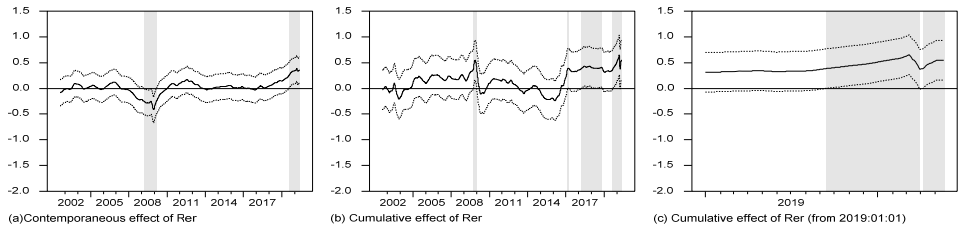


U.S.

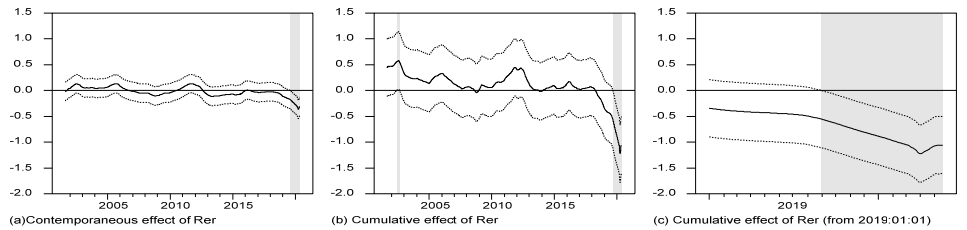
Figure 3.: Time-varying exchange rate parameters



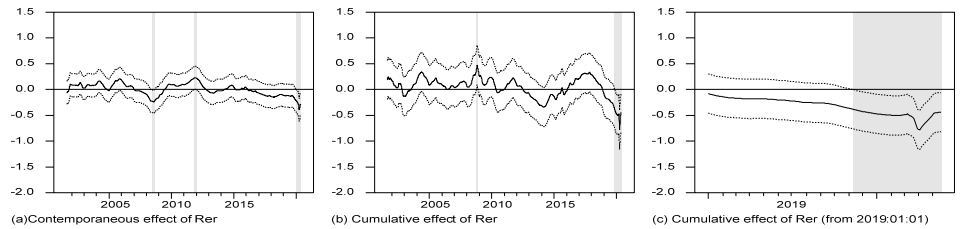
U.K.



Italy

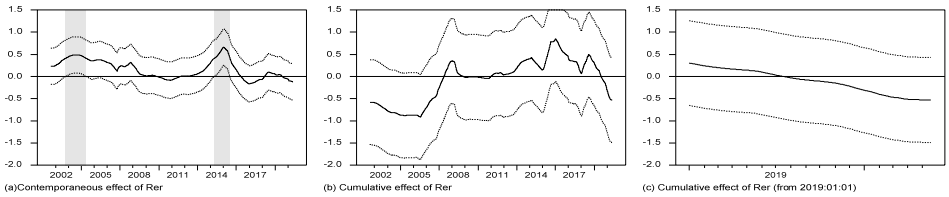


Spain



France

Figure 3. (continued): Time-varying exchange rate parameters



China

Figure 3. (continued): Time-varying exchange rate parameters

Note: Shaded areas show the intervals where time-varying coefficients are significant.

4. Conclusion

Since December 2019, the COVID-19 pandemic has created a global crisis affecting the majority of the world economies. Along with the impacts on the health system, the spreading of the virus has forced governments to take lockdown measures leading to further expansion of the crisis to the rest of the sectors. Even though a majority of the countries heavily affected by the pandemic have recently introduced various stimulus packages in the form of tax reliefs, offering access to low-interest rate loans, an extension of credit repayments, or cash handouts, they have been so far failed to recover economies from the recession triggered by the pandemic. As a result of the ongoing spread of the virus at a faster rate, the demand for commodities related to travel and transportation activities, especially oil demand, has declined markedly.

In this perspective, this paper examined the impacts of oil price exposure on the oil-gas industries of countries significantly impacted by COVID-19. Through the use of a time-varying state-space model, the impact of the overall market, oil price, and exchange rate risks on the asset-pricing behavior of the oil-gas industry has been investigated. The results suggest that the plunge in oil prices experienced after the outbreak of Coronavirus has important and significant implications on the oil-gas sectors of the countries. In particular, a positive and significant effect of oil prices documented by the previous studies (Aloui et al., 2012; Nandha and Faff, 2008; Ramos and Veiga, 2011; El-Sharif et al. 2005) has disappeared and turned into negative during the period of the pandemic. Also, the market risks have risen with the announcement of the new confirmed cases in almost all countries. Our results also suggest that although the Coronavirus originated from China, its oil-gas sector seems unaffected by the COVID-19 outbreak. For further studies, it will be convenient to investigate the impacts of the COVID-19 crisis on the other sectoral stock returns, tourism, transportation, airlines, and spillover between the connected markets affected by the global lockdown.

REFERENCES

[1]Aloui, C., Nguyen, D. K., Njeh, H.(2012), ***Assessing the Impact of the Oil Price Fluctuations on Stock Returns in Emerging Markets.*** *Economic Modelling*, 29, 2686-2695;

[2]Bianconi, M., Yoshino, J. A.(2014), ***Risk Factors and Value at Risk in Publicly Traded Companies of the Nonrenewable Energy Sector.*** *Energy Economics*, 45, 19-32;

[3]Boyer, M., Filion, D. (2007), ***Common and Fundamental Factors in Stock Returns of Canadian Oil and Gas Companies.*** *Energy Economics*, 29(3), 428-453;

[4]Chen, M. H., Jang, S. S., Kim, W. G.(2007), ***The Impact of the SARS Outbreak on Taiwanese Hotel Stock Performance: An Event-Study Approach****. International Journal of Hospitality Management*, 26(1), 200-212;

[5]Commandeur, J. F., Koopman, S. J.(2007), ***An Introduction to State Space Time Series Analysis*****,** *U.K. Oxford University Press*;

[6]Conlon, T., McGee, R.(2020), ***Safe Haven or Risky Hazard? Bitcoin during the Covid-19 Bear Market****. Finance Research Letters*, 35, 101607;

[7]Corbet, S., Larkin, C., Lucey, B.(2020), ***The Contagion Effects of the COVID-19 Pandemic: Evidence from Gold and Cryptocurrencies.*** *Finance Research Letters*. 35, 101554;

[8]Del Giudice, A., Paltrinieri, A.(2017), ***The Impact of the Arab Spring and the Ebola Outbreak on African Equity Mutual Fund Investor Decisions.*** *Research in International Business and Finance*, 41, 600-612;

[9]El-Sharif, I., Brown, D., Burton, B., Nixon, B., Russell, A. (2005), ***Evidence on the Nature and Extent of the Relationship between Oil Prices and Equity Values in the U.K.*** *Energy Economics*, 27, 819-830;

[10]Goodell, J. W.(2020), ***COVID-19 and Finance: Agendas for Future Research*****,** *Finance Research Letters*, 101512;

[11]International Energy Agency(2020), ***Global Energy Review 2020. The Impact of the Covid-19 Crisis on Global Energy Demand and CO2 Emissions*****;**

[12]Jones, C. M., Kaul, G.(1996), ***Oil and the Stock Markets.*** *The Journal of Finance*, 51(2), 463-491;

[13]Kalman, R. E.(1960), ***A New Approach to Linear Filtering and Prediction Problems.*** *Journal of Basic Engineering*, 82, 35-45;

[14]Kim, C. J., Nelson, C. R.(1999), ***Has The U.S. Economy Become More Stable? A Bayesian Approach Based On A Markov-switching Model of the Business Cycle.*** *The Review of Economics and Statistics*, 81(4), 608-616;

[15]Liu, H., Manzoor, A., Wang, C., Zhang, L., Manzoor, Z. (2020), ***The COVID-19 Outbreak and Affected Countries Stock Market Response.*** *International Journal of Environmental Research and Public Health*, 17(8), 2800;
[16]Loh, E.(2006), ***The Impact of SARS on the Performance and Risk Profile of Airline Stocks.*** *International Journal of Transport Economics*, 33(3), 401-422;
[17]McSweeney, E. J., Worthington, A. C.(2008), ***A Comparative Analysis of Oil as a Risk Factor in Australian Industry Stock Returns, 1980-2006.*** *Studies in Economics and Finance*, 25(2), 131-145;
[18]Moya-Martínez, P., Ferrer-Lapeña, R., Escribano-Sotos, F.(2014), ***Oil Price Risk in the Spanish Stock Market: An Industry Perspective.*** *Economic Modelling*, 37, 280-290;
[19]Nandha, M., Faff, R.(2008), ***Does Oil Move Equity Prices? A Global View.*** *Energy Economics*, 30, 986-997;
[20]Nippani, S., Washer, K. M.(2004), ***SARS: A Non-event for Affected Countries' Stock Markets?*** *Applied Financial Economics*, 14(15), 1105-1110;
[21]Ramos, S.B., Veiga, H.(2011), ***Risk Factors in Oil and Gas Industry Returns: International Evidence.*** *Energy Economics*, 33, 525-542;
[22]Sharif, A., Aloui, C., Yarovaya, L.(2020), ***COVID-19 Pandemic, Oil Prices, Stock Market, Geopolitical Risk and Policy Uncertainty Nexus in the U.S. Economy: Fresh Evidence from the Wavelet-based Approach.*** *International Review of Financial Analysis*, 70, 101496;
[23]Tran, T. K., Sato, H., Namatame, A.(2017), ***Key Economic Sectors and Their Transitions: Analysis of World Input-Output Network. In Robustness in Econometrics*** (pp. 381-399)". *Springer, Cham*;
[24]World Bank. (2020), ***Commodity Markets Outlook: Implications of COVID-19 for Commodities.***