# COVID-19, Oil Price, Bitcoin, and Economic Policy Uncertainty: Evidence from ARDL Model

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## **Keywords:**

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# Abstract

The pandemic of coronavirus (COVID-19) creates fear and uncertainty causing extraordinary disruption to financial markets and global economy. Witnessing the fastest selloff in the American stock market in history with a plunge of more than 28% in S&P 500 has increased the volatility of global financial market to exceed the level observed during the financial crisis of 2008. On the other hand, Bitcoin value has shown considerable stability in the last couple of months peaking at \$10,367.53 in the mid of February 2020. In this context, the aim of this paper is to investigate the impact of COVID-19 numbers on Bitcoin price taking into consideration number of controlling variables including WTI-oil price, S&P 500 index, financial market volatility, gold prices, and economic policy uncertainty of the US. To do so, ARDL estimation has been applied using daily data from December 31, 2019 till May 20, 2020. Key findings reveal that the daily reported cases of new infections have a marginal positive impact on Bitcoin price in the long term. However, the indirect impact associated with the fear of COVID-19 pandemic via financial market stress cannot be neglected. Bitcoin can also serve as a hedging tool against the economic policy uncertainty in the long term. In the short run, while the returns of economic policy uncertainty have no impact on Bitcoin price, the growth in the new cases of COVID-19 infection and returns of financial market volatility have more positive significant impact on Bitcoin returns.

# **Objective**(s)

the aim of this study is to investigate the impact of the growth of daily COVID-19 cases on the return of Bitcoin in the short run, while controlling for the role of returns on crude oil prices (WTI), returns of US S&P 500 stock prices, changes in both financial stress and volatility (VIX index), and the US economic policy uncertainty (EPU).

## Methodology

Since the aim of this paper to investigate the relationship between COVID-19 new cases and Bitcoin prices, total daily infected cases have been extracted from the database of WHO reports starting with 31 December 2020 till 20 May 2020 (142 observations). Bitcoin prices (BTC) are extracted from Yahoo Finance. The study includes several control variables including:

(a) S&P 500 Stock Prices: Since stock prices are key indicators of both macroeconomic and financial development, many recent research papers have investigated the relationship between them. For example, Ciaian et al. (2016) and Van Wijk (2013) noted that the migration

of traditional investors to cryptocurrencies has raised the correlation between Bitcoin and stock prices.

- (b) Financial Volatility Index (VIX): The need of a common benchmark of volatility that may work as a reference point of market exposure for investors has encouraged the use of VIX index in many financial market studies.
- (c) Oil prices: The oil prices are also considered as a determinant of Bitcoin prices (Ciaian et al., 2016). Oil prices are attributed to inflationary pressure in an economy. Thus, the price of Bitcoins may be aligned with potential change in general price level that are associated with signals of oil price oscillations (Ciaian et al., 2016).
- (d) Economic Policy Uncertainty: The US EPU has been included as another critical determinant of Bitcoin prices. The EPU is a newspaper-based index of uncertainty constructed from News Bank Access World News Database. This index reflects the overall viability of the business environment and investment and investment prospects; thus, this variable has gained considerable recognition in financial literature as an indicator of risk (Al-Yahyaee et al., 2019). Demir et al. (2018) analyzes the predictive power of EPU on Bitcoin returns and concludes that Bitcoin is a hedging tool for economic uncertainty.

Variables	Moon	St.	Minimum	Maximum	Skewness	Kurtosis
Description	Mean	deviation	WIIIIIIIIII	Maximum		
Bitcoin	8183.59	1347.599	4970.788	10326.05	-0.448	2.262
COVID-19	34234.8	37593.54	0	101445	0.435	1.374
WTI	37.247	17.4965	-36.98	63.27	-0.455	3.419
S&P 500	2977.94	309.302	2237.4	3386.15	-0.384	2.121
VIX	32.71	18.09709	12.1	82.69	0.654	2.579
US EPU	324.816	227.3582	22.25	869.86	0.439	1.929

Table 1. Descriptive statistics

## **Unit Root Testing**

This paper uses Augmented Dickey and Fuller (ADF) test which is an augmented version of the original Dickey and Fuller test (1979) that has been modified to accommodate more complex models with unknown orders (the augmented Dickey-Fuller test):

$$\Delta y_{t} = \theta_{0} + \alpha_{0}t + \alpha_{1}y_{t-1} + \sum_{i=0}^{p} \theta_{i}\Delta y_{t-1} + \mu_{t}$$
(1)

where  $y_t$  is the variable in period t;  $\Delta y_{t-1}$  is the  $y_{t-1}$ - $y_{t-2}$ ; the i.i.d. disturbance  $\mu_t$  has mean 0 and variance 1; t the linear time trend and p is the lag order. To test the null hypothesis for the presence of a unit root in  $y_t$ , the hypothesis testing that  $\alpha_1 = 0$  in Equation (1) has been conducted. If  $\alpha_1$  is significantly less than zero, the null hypothesis of a unit root is rejected. Results of ADF are obtained for both level and first differenced variables as a treatment for non-stationary data. In addition, Phillips and Perron (1988) unit root test has been applied for robust check.

### **ARDL Estimation**

The log-linear specification can produce more consistent and efficient results than the linear model. Furthermore, the natural log model should help to persuade stationarity in the variance-covariance matrix as follows:

 $\ln(BTC)_{t} = \mu_{0} + \mu_{1} \ln(COVID - 19)_{t} + \mu_{2} \ln WTI_{t} + \mu_{3} \ln SP500 + \mu_{4} \ln VIX_{t} + \mu_{5} \ln EPU_{t} + \varepsilon_{t} (2)$ 

where  $\varepsilon_t$  is the regression error term and the intercept of the model is given by  $\mu_0$ . The coefficients  $\mu_0, \mu_1, \mu_2, \mu_3, \mu_4$  and  $\mu_5$  represent, respectively, the impacts of COVID-19 new cases, fluctuations in crude oil price (WTI), US stock market (SP500), volatility in the global financial market, and the US economic policy uncertainty (EPU). Once the integration level is confirmed for all variables that are included in the estimation, the existence of lon-run relationship among the variables is tested using ARDL bound testing. The error correction model (ECM) can be represented as below:

 $\Delta \ln (BTC)_t = \delta_0 + \sum_{i=0}^n \delta_{1i} \Delta \ln COVID - 19_t + \sum_{k=0}^q \delta_{1k} \Delta \ln WTI_t + \sum_{j=0}^d \delta_{2j} \Delta \ln SP500_t + \sum_{l=0}^b \delta_{3l} \Delta \ln VIX_t + \sum_{w=0}^y \delta_{4w} \Delta \ln EPU_t + \theta ECT_{t-1} + \varepsilon_t$ 

	ADF		PPerron	PPerron		
Variable	Constant	Constant and	Constant	Constant and		
		Trend	Constant	Trend		
lnBTC	-1.74	-1.75	-1.75	-1.75		
lnCOVID-19	-3.04**	-2.15	-2.04	-4.51***		
lnWTI	-1.59	-1.26	-2.79	-2.78		
lnSP500	-1.33	-1.17	-1.44	-1.44		
lnVIX	-1.42	-0.61	-1.35	-0.80		
lnUS-EPU	-1.12	-3.09	-1.79	-5.23***		
ΔlnBTC	-7.32***	-7.29***	-13.67***	-13.63***		
∆lnCOVID-19	-6.86***	-6.88***	-31.93***	-32.65***		
$\Delta$ lnWTI	-6.59***	-6.72***	-12.78***	-12.92***		
$\Delta lnSP500$	-6.87***	-6.88***	-15.44***	-15.43***		
$\Delta lnVIX$	-5.87***	-5.98***	-13.25***	-13.33***		
∆lnUS-EPU	-10.15***	-10.12***	-23.58***	-23.54***		

#### Table 2. Unit Root Test

**Results/Findings** 

*Note.* (i) \*\*\*, \*\* and \* means significance at 1%, 5% and 10%; (ii) the optimal lag selection is based on AIC information criterion; (iii) BTC refers to the bitcoin prices, (iv) COVID-19 refers to the global new cases of world.

Results of the bound test shown in Table 3 reveals that the F-statistics of 3.45 is significant at 1% level.

Model	Optimal I structure	lag	F - value	p-value
BTC = f (COVID - 19, WTI, SP500, VIX, EPU	) $(1, 0, 1, 0, 0, 1)$	)	3.450	0.000

Table 3. Results of ARDL bound testing to cointegration

Following the above, results of ARDL estimation are presented in Table (4). Looking at the upper section of the table, estimates of the long-run relationship between Bitcoin, COVID-19, WTI, S&P500, and VIX are statistically significant at 1% and 5% level, except for the EPU.

Table 4. Estimated coefficients from ARDL (1,0,1,0,0,1) for model

BTC = f (COVID - 19, WTI, SP500, VIX, EPU)				
	Variable	Coefficients	t-stat	
	$COVID - 19_t$	0.001	1.787**	
Long mun actimates	WTI <sub>t</sub>	-0.014	-2.58**	
Long run estimates	<i>SP</i> 500 <sub><i>t</i></sub>	-0.181	-10.67***	
	VIX <sub>t</sub>	0.209	-2.09**	
	$EPU_t$	-0.042	-1.490	
	$COVID - 19_{t-1}$	0.004	3.17**	
	$WTI_{t-1}$	-0.057	-2.48**	
Shout was astimated	$SP500_{t-1}$	-0.808	-4.58***	
Short run estimates	$VIX_{t-1}$	0.529	4.366***	
	$EPU_{t-1}$	- 0.006	-0.680	
	$ECT_{t-1}$	-0.736	-3.28***	

The robustness results shown in Table (5) show that the estimation is stable with no serial correlation.

Table 5. Diagnostic tests

Test	Coefficient
$R^2$	0.74
Adjusted $R^2$	0.67
F- statistics	11.105(0.017)
Jarque-Bera normality test	1.030(0.308)
Breusch-Godfrey Serial Correlation LM Test	0.707(0.306)

All in all, even if the direct positive impact of COVID-19 new infection cases on Bitcoin price might be promising for investors to allow them to fly to another platform, the negative impact on

both stock market and the global financial stress cannot be neglected. Given the speed of propagation of this pandemic virus, if the world governments are not proactive, promptly implementing the required measures to isolate the suspected cases of COVID-19, the global economy risk to be paralyzed in few weeks.

## Implications

Fears and low confidence in market associated with the persistence of coronavirus may lead to a dreadful economic contraction. Although couple of countries such as China and New Zealand seem to gain the fight against COVID-19, the virus exponentially propagates in different regions including GCC, Europe and the US. Consequently, a strong coordinated worldwide reaction is required, including economic measures to prevent a severe economic downturn. Central banks have already started to cut the interest rates, but this measure should be followed by appropriated fiscal facilities.

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