The Impact of Covid-19 and Crude Oil Price on Economic Policy Uncertainty; Evidence from an Emerging Market Economy

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Abstract

This study aimed to measure the effects of Covid-19 and crude oil price on economic policy uncertainty (EPU) by the ARDL bound test. Results show that, new deaths (0,19) and new cases (0,04) had a significant impact on the EPU in the long-run, while the recovery had not. In addition, the crude oil price also has an inverse and significant effect on the EPU (-2,66 long-run). The findings show that the decline in oil price is expected to cause a decrease in the current account deficit and therefore a decrease in uncertainty in an emerging economy where the current account deficit creates extreme fragility, Covid-19 has increased uncertainty by dominating this situation.

Key words: Crude oil, ARDL, economic policy uncertainty, covid, coronavirus, EPU, emerging markets

Jel Codes: G01, H12, Q12

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Covid-19 ve Ham Petrol Fiyatlarının Ekonomi Politikası Belirsizliğine Etkisi; Gelişmekte Olan Ülke Örneği

Öz

Bu çalışma ile Covid-19 ve ham petrol fiyatının ekonomi politikası belirsizliği (EPU) üzerindeki etkilerinin ARDL sınır testi ile ölçülmesi amaçlanmıştır. Sonuçlar, yeni ölümlerin (0,19) ve yeni vakaların (0,04) uzun vadede EPU üzerinde önemli bir etkiye sahip olduğunu, ancak iyileşmenin herhangi bir etkisi olmadığını göstermektedir. Ayrıca ham petrol fiyatının da EPU üzerinde ters ve önemli bir etkisi vardır (uzun vadede -2,66). Bulgular, cari açığın aşırı kırılganlık yarattığı gelişmekte olan bir ekonomide petrol fiyatındaki düşüşün cari açıkta düşüşe ve dolayısıyla belirsizlikte azalmaya neden olurken, Covid-19'un bu durumu domine ederek belirsizliği artırdığını gösteriyor**.**

Anahtar Kelimeler: Ham petrol, ARDL, ekonomi politikası belirsizliği, covid, koronavirus, EPU, gelişmekte olan piyasalar

Jel Kodları: G01, H12, Q12

1. Introduction

The new coronavirus (Covid-19) has become the world's most important subject in recent days.The covid-19 pandemic, which began in China, caused more than 19.5 million cases and more than 930 thousand deaths worldwide.The numbers continue to increase.World Health Organization declared Covid-19 as pandemic on March 11, 2020.Covid-19, which started in China, began to spread much faster and have strong influences in countries other than China. The increasing rate of spread and death numbers have caused fear and panic in communities.As states tried to control the rate at which the virus spread, economic impacts were at an all-time high.The spread of economic negativity in all sectors and the lack of adequate measures against it led to the formation of a widespread economic policy uncertainty (EPU) all over the world.Under these circumstances, the measures taken by states and unclear strategies were extremely insufficient to combat the devastating impact of the virus.Although economic destruction has a significant impact on all countries, it is much greater on underdeveloped and developing countries.The effects of Covid-19 on the EPU, which has a very short history, are examined in the literature, especially in developed countries such as the UK and US (Albulescu, 2020; Baker et al. 2020; Moran et al.2020). Since no studies have been found on

developing countries in this context, this study will also fill a significant gap in the literature.The fragile structure of developing countries requires that these and similar studies focus on developing countries.The increasing numbers of cases and deaths in the world due to the Covid-19 pandemic caused major problems in the supply chain, especially in April and May in developing and developed countries, where economic effects are noticeably felt.With the spread of the pandemic, the decrease in consumption due to the social isolation and the perception of security caused an important vicious circle in the world.The extreme decline in oil demand is the most important indicator of this.While the decline in oil demand has caused downward movement of prices, there are few studies measuring the economic and political effects of this in times of crisis for developing countries such as Turkey, which are net oil importers.In oil-dependent countries, the fall in oil prices is also expected to reduce the uncertainty.If the results to be obtained are in the direction of increasing uncertainty despite falling oil prices due to covid-19, it can also be concluded that covid-19 has a very strong effect.

Turkey, which is chosen to represent developing countries as a bridge between Europe and Asia, is the only developing country to be a member candidate of the European Union on the one hand and a Muslim on the other.With a GDP of $754 billion, Turkey is ranked 20th among the G20 countries in December 2019, after Saudi Arabia. (TradingEconomics, 2020). As of 24 September 2020, 269,550 people have been infected with corona in Turkey, and 6326 people have died due to Covid-19. If we go back to the main reason of this study, did the Covid-19 crisis cause a change in economic policy uncertainty in developing countries?I tried to answer this question by analyzing the effects of Covid-19 new cases, new deaths and recovery on EPU in Turkey.In the study, I used daily data between April 4, 2020 and September 16, 2020. In addition, I tested the effects of Brent crude oil price on Turkey EPU.As I mentioned earlier, Turkey is an oil-dependent country and it is expected that crude oil price shocks will affect the economic policy uncertainty. In particular, price reductions are expected to have lowering effectson uncertainty. This is why oil price was also used when the covid-19 effect was measured in the study. If the results show that Covid-19 has an EPU-enhancing effect even in energy-dependent developing countries, it will be clear that the pandemic effect is quite high.

The studies which examined the relationship between the EPU and crude oil price in developed countries (Kang &Ratti, 2013; Chen et al. 2020; Quadan& Nama, 2018; Kang et al. 2017; Rahman &Serletis, 2011) found that oil price shocks had a positive effect on the EPU, while (Antonakasis et al.

2014) found negative effects. However, (Degiannakis et al. 2018) concluded that changes in oil price had no effect on the EPU. On the other hand, (Aloui et al. 2016) found that crude oil yields only had an impact on economic policy uncertainty during certain periods, and that this effect disappeared during periods of financial crisis, while (Berger & Uddin, 2016) concluded that volatility in oil price had an impact on uncertainty. In his study assessing developed and developing countries together (Rehman, 2018) concluded that India, Spain and Japanese economic policy uncertainty were affected by oil price shocks. Studies conducted in India, which is a developing country, (Montasser et al. 2014) found no relationship between oil price changes and economic uncertainty, while (Cunado et al. 2005) concluded that oil price shocks had a positive effect on the EPU. In his study looking at its effects in China (Wang, 2019) found that fluctuations in oil price would have significant effects on EPU, indicating an inverted U shape. However, from studies measuring the effects of the covid-19 pandemic on EPU; (Jeris&Nath, 2020)found that Covid-19 new deaths and Covid-19 new cases has strong amd positive impact on EPU in the long-run however Brent oil price have an inverse impact on EPU in the long run.In his study measuring the effects of Covid-19 and oil price on EPU in the US (Albulescu, 2020) found that Covid-19 new cases and Covid-19 newdeaths have no significant impact on EPU of US nevertheless oil price has inverse influence on EPU.Moreover (Matuka, 2020) found covid-19 new cases have a strong impact on US EPU hovewer covid-19 new deaths have no strong impact on US EPU. Additionally he found that brent oil price changes have significant impact on EPU. In the meantime, some other studies measuring the effects of Covid-19 on EPU are; (Sharif et al.2020; Altig et al.2020; Pata, 2020; Caggiano et al.2020).But none of these studies measured the effects of Covid-19 new deaths, new cases, recovering and crude oil price on EPU in developing countries.

The primary aim of this study is to measure the effects of Covid-19 and crude oil price on economic policy uncertainty by the ARDL bound test. Furthermore the study, is conducted in a developing country that is considered to be much more affected by the pandemic than developed countries, is the first time. By this means, developing countries will be able to take precautions in advance for such global crisis situations. The study mainly consists of 4 parts. Following the introduction, in the second part of the study; The data set was included by mentioning the material and method and the ARDL model was introduced as a method. In the third part; performed empirical application and empirical findings are included. The fourth part is completed with the conclusion and discussion. It is expected that the method and data set used in the study will contribute to the literature in terms of being up-to-date.

2. Data and Variables

In this study, I tried to measure the effects of Covid-19 on economic and political uncertainty in emerging market economies.That's why I used the EPU index as a dependent variable in the study.On the other hand, I used Covid-19 daily new cases, daily new deaths and daily new recoveries as independent variable.I also added the daily price of Brent oil to measure its impact on the EPU, along with other variables.Brent oil is the most traded type of oil in the world.I obtained daily data about Covid-19 from the website of the Ministry of Health of the Republic of Turkey.The EPU index (Bilgin et al. 2019) and (Castelnuovo & Tran, 2017) were obtained by the method they used in their studies.Data on Brent Crude Oil was obtained from investing.com.The study was carried out with 117 days of data covering working days between 04.04.2020 and 16.09.2020. Figure 1 shows Covid-19 daily new cases, daily new deaths, daily new recoverings, economic policy uncertainty index developed by (Bilgin et al. 2019) and (Castelnuovo & Tran, 2017) and brent crude oil prices.

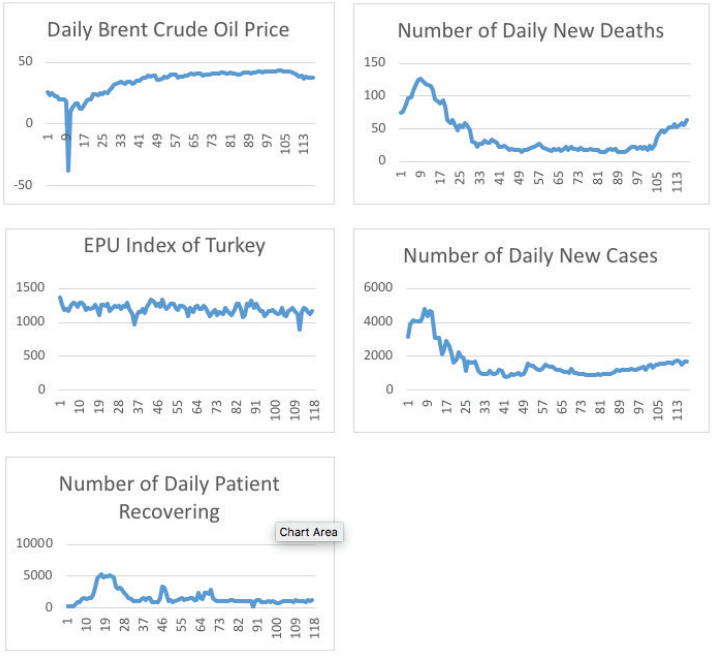

Figure 1. Turkey Covid-19 daily new cases, daily new deaths, daily new patient recovering, EPU index of Turkey and Brent crude oil price. Source: Authors' own estimation.

3.1. Autoregressive-Distributed Lag (ARDL)

The method used in the study is Autoregressive Distributed Lag (ARDL) method developed by (Peseran et al. 2001).There are many reasons why the ARDL method was chosen in this study. The most important of these are;1) ARDL can be easily used in small sample sizes (Jeris&Nath, 2020), (Ahmad et al. 2020), (Narayan, 2004). 2) ARDL allows long-term and short-term estimates to be made together (Tursoy& Faisal, 2016). 3). It can be used in cases where series are stationary at the level or first differences, but none of them need a second level for stationarity (Menegaki, 2019), (Geyikçi, 2017). Due to the reasons I mentioned, the most suitable method in analyzing the data examined in this study is the ARDL method.

ARDL approach is applied as a Vector Autoregressive (VAR) model of p. The following form was applied in the ARDL approach used in the co-integration test;

$$EPU_t = \alpha_{01} + \beta_{11}(EPU_{t-1}) + \beta_{12}(COVNEWDEATHS_{t-1}) + \beta_{13}(COVNEWCASES_{t-1}) + \beta_{14}(COVRECOVERING_{t-1}) + \sum_{i=1}^{P}\alpha_{1i}(EPU_{t-i}) + \sum_{i=1}^{P}\alpha_{2i}(COVNEWDEATHS_{t-i}) + \sum_{i=1}^{P}\alpha_{3i}(COVNEWCASES_{t-i}) + \sum_{i=1}^{P}\alpha_{4i}(COVRECOVERING_{t-i}) + \varepsilon_{it}$$

In the equation, the variables EPU, COVNEWDEATHS, COVNEW-CASES and COVRECOVERING represent the error term ε. In the equation given above, the H_0 hypothesis is that there is no cointegration, and the alternative hypothesis is that there is cointegration. The null hypothesis was tested by applying the F test.

Hence

$H_0 = \beta_{1i} = \beta_{2i} = \beta_{3i} = \beta_{4i} = 0$

$H_1 = \beta_{1i} \neq \beta_{2i} \neq \beta_{3i} \neq \beta_{4i} \neq 0$

I=1, 2, 3, 4

The long-term equilibrium relationship between variables is calculated using the long-term ARDL model for the (EPUt) given in the equation below. The main purpose here is to examine the effects of COVNEWDEATHS, COVNEWCASES and COVRECOVERING variables on EPU.

$$EPU_t = \alpha_0 + \sum_{i=1}^{P}\alpha_{1i}(EPU_{t-i}) + \sum_{i=1}^{P}\alpha_{2i}(COVNEWDEATHS_{t-i}) + \sum_{i=1}^{P}\alpha_{3i}(COVNEWCASES_{t-i}) + \sum_{i=1}^{P}\alpha_{4i}(COVRECOVERING_{t-i}) + \varepsilon_{it}$$

The formula used in the study for short-term is below;

$$EPU_t = \alpha_0 + \sum_{i=1}^{P} \alpha_{1i} (EPU_{t-i}) + \sum_{i=1}^{P} \alpha_{2i} (COVNEWDEATHS_{t-i}) + \sum_{i=1}^{P} \alpha_{3i} (COVNEWCASES_{t-i}) + \sum_{i=1}^{P} \alpha_{4i} (COVRECOVERING_{t-i}) + \varepsilon_{it}$$

In the equation, Δ represents short term, δ represent long term, i represent the maximum number of lags, ECT represents Error Correction Adjustment, θ represents spread of adjustment and ε represents error term.

3. Results

3.1. Summary statistics

Information about the data used in the study is summarized in Table 1. Economic policy uncertainty (INDEX) mean is 1198,39 while the mean of new cases 1629,01; new deaths 40,27; crude oil 34,31 and recovering 1604.10.

Table 1. Descriptive Statistics

	INDEX	NEWCASES	NEWDEATHS	CRUDEOIL	RECOVERING
Mean	1198,39	1629,01	40,27	34,31	1604,10
Median	1201,00	1243,00	23,00	38,75	1156,00
Maximum	1361,00	4801,00	126,00	43,39	5231,00
Minimum	889,00	786,00	14,00	-37,63	104,00
Std.Dev	71,00	961,31	31,25	10,97	1159,80
Skewness	-0.838	1,95	1,37	-2.93614	1,91
Kurtosis	5,51	5,86	3,72	17,22	5,84
Jarque-Bera	44,48	114,23	39,14	1154,56	110,33
Probability	0,000	0,000	0,000	0,000	0,000
Sum	140211	190594	4712	4014	187680
Observations	117	117	117	117	117

Notes: INDEX; Economic politic uncertainty index, NEWCASES; Daily covid19 new cases, NEWDEATHS; Daily covid19 new deaths, CRUDEOIL; daily Brent crude oil price, RECOVERING; daily covid19 new recovering.

Table 2 shows correlations between variables. As expectedly EPU index has positive correlation with NEWCASES, NEWDEATHS, RECOVERY and negative correlation with CRUDEOIL. Additionally,new cases, new deaths and recovering has negative correlation with crude oil.

Table 2. Correlation Matrix

	INDEX	NEWCASES	NEWDEATHS	OIL PRICE	RECOVERING
INDEX	1				
NEWCASES	0,242	1			
NEWDEATHS	0,178	0,912	1		
CRUDEOIL	-0,292	-0,754	-0,825	1	
RECOVERY	0,156	0,096	0,311	-0,428	1

Notes: INDEX; Economic politic uncertainty index, NEWCASES; Daily covid19 new cases, NEWDEATHS; Daily covid19 new deaths, CRUDEOIL; daily Brent crude oil price, RECOVERING; daily covid19 new recovering. Source; Authors' calculation.

Table 3. shows unit root test results of the variables. I considered the Augmented Dickey Fuller and Phillips Perron unit root tests. As shown at the table all of the variables are stationary at the level or at their first differences, and it is seen that they meet the necessary conditions for ARDL since none of them need the second difference for stationarity.

Table 3. Unit Root Tests Results

Intercept Level	**ADF test statistics**	**Prob.**	**Result**	**PP test statistics**	**Prob.**	**Result**
Recovering	-3,2689***	0,0767	I(0)	-2,9008	0,1662	Non-Stationary
Crude Oil	-1,7775	0,7092	Non-Stationary	-5,8706	0,0000	I(0)
New Cases	-1,8810	0,6578	Non-Stationary	-1,4176	0,8509	Non-Stationary
New Deaths	0,1017	0,9970	Non-Stationary	-0,5726	0,9786	Non-Stationary
Index	-6,9662	0,000	Non-Stationary	-6,8366	0,0000	I(0)
Intercept In the first Difference	**ADF test statistics**	**Prob.**	**Result**	**PP test statistics**	**Prob.**	**Result**
Recovering	-8.8298*	0,0000	I(I)	-8.7167*	0,0000	I(I)
Crude Oil	-8.1524*	0,0000	I(I)	-36.0687*	0,0001	I(I)
New Cases	-10.4094*	0,0000	I(I)	-13.0174*	0,0000	I(I)
New Deaths	-8.3035*	0,0000	I(I)	-8.4742*	0,0000	I(I)
Index	-9.9718*	0,0000	I(I)	-26.4185*	0,0001	I(I)
Critical Values	1%		-4,042	1%		-4,040
	5%		-3,450	5%		-3,449
	10%		-3,151	10%		-3,150

Notes; * is 1% significance level. The optimal lag selected based on Akaike (AIC).

The estimated VAR is stable (stationary) if all roots have modulus less than one and lie inside the unit circle. As seen in the Figure 2. the model is stable.

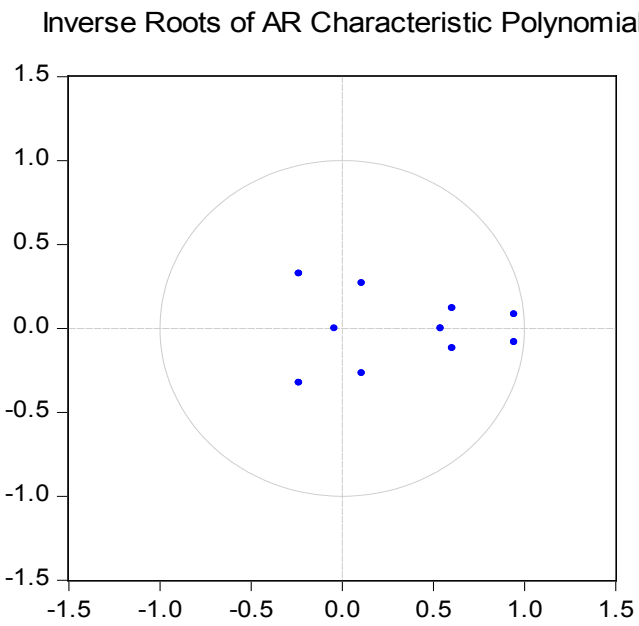

Figure 2. Inverse Roots of AR Characteristic Polynomial

Table 4. Lag Length Criteria

In order to perform the ARDL Bound test, the appropriate lag length must first be determined. In determining the lag length, Akaike (AIC) information criteria are taken into account and the lag length providing the smallest critical value is determined as the lag length of the model. As seen in Table 4. appropriate lag length for the model is 2nd lag.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3.739.879	NA	1.39e+23	6.747.529	6.759.734	6.752.480
1	-3.361.686	7.154.999	2.39e+20	6.111.146	61.84376*	61.40853*
2	-3.325.993	6.431.181	1.98e+20*	60.91879*	6.226.135	6.146.342
3	-3.308.306	3.027.416	2.27e+20	6.105.056	6.300.338	6.184.276
4	-3.290.296	2.920.504	2.61e+20	6.117.651	6.373.958	6.221.627
5	-3.259.180	4.765.520	2.39e+20	6.106.631	6.423.964	6.235.364
6	-3.230.629	41.15513*	2.31e+20	6.100.233	6.478.590	6.253.721

3.2. Bound test results

As shown in Table 5. The result of F statistics is bigger than critical values. Critical values for these series are derived from the study of (Narayan & Narayan, 2005). According to the theory, if the statistical value of F is above

upper bound, it means that there is a cointegration relationship between the series. In this context, there is a long-term co-integration relationship between the EPU index and new cases, new deaths, new recovering and crude oil price.

Table 5. Bound Test Results

Variables	F Statistics	
f (Index/NewCases, NewDeaths, Crudeoil, Recovering)	8.866976	
Critical Value Bounds		
Significance	I(0) Bound	I(I) Bound
1%	3.74	5.06
5%	2.86	4.01
10%	2.45	3.52

Critical values at 5% significance level

3.3. Regression analysis

Table 6. shows the long-term ARDL results for the established model. In the long-run, new deaths and new cases have positive and significant impact on uncertainty meaning that a rising in both new cases and new deaths enhance uncertainty in Turkey. This result coincides with (Jeris & Nath, 2020) and (Albulescu, 2020). On the other hand, a negative relationship is observed in the long-run between crude oil and economic policy uncertainty, which means that uncertainty increases as crude oil prices fall. This result is consistent with (Jeris & Nath, 2020), (Albulescu, 2020), (Hailemariam et al. 2019), (Chen et al. 2020). Another finding that can be obtained from Table 6. is that increases in newcases and newdeaths have a negative impact on the price of crude oil. This result is the same as the results obtained in (Albulescu, 2020). Among the variables examined, a long-run relationship was not observed only between recovery and economic policy uncertainty. There is strong short-run relations among all variables in the model. All diagnostic tests are passed the probability chi-square values in the model.

Table 6. ARDL Test Results

Long run equation	Coefficient	t-statistics	Prob.
C	1267,960	16,4323	0,0000*
$NEWCASES_t$	0,049674	1,7847	0.0774***
$NEWDEATHS_t$	0,194899	2,2378	0.0193**
$CRUDEOIL_t$	-2,665885	-1,8399	0.0688***
$RECOVERING_t$	0,012048	1,3390	0,1837
Short run equation			
$NEWCASES_{t+1}$	0,038724	2,399364	0.0181*
$NEWDEATHS_{t+1}$	-0,140047	-2,612255	0.0103*
$CRUDEOIL_{t+1}$	-1,86843	-1,976627	0.0506**
$RECOVERING_{t+1}$	0,011726	1,928756	0.0563**
ECT_t	0,394719	4,681618	0.0000*
Diagnostic Tests			
Normality	2,112		
Serial Correlation	0,566		
Heteroskedasticity	0,778		
ARCH	1,221		
Ramsey reset	0,724		
CUSUM	Stable		
CUSUM Sq	Stable		

Notes: ***, ** and * means significance at 1%, 5% and 10%; Breusch-Godfrey LM test for serial correlation is used; ARCH effects for conditional heteroscedasticity; Breusch- Godfrey Serial Correlation LM test for serial correlation; Jarque-Bera test for normality.

Table 6. also shows that; The Breusch-Godfrey LM test for serial correlation value of 0.566 (greater than 0.05) indicates that there is no serial correlation problem among these residues. Heteroscedasticity test has R-squared and F statistics both above 5%. In addition, the probability value (1,221) is greater than 5%, which means the model has no heteroskedasticity problem. Jarque-Bera statistics were applied to verify whether the data were normally distributed under different conditions and according to assumptions. The test depends primarily on the P value, and the null hypothesis is rejected if the P value of the test is less than 5%. (Jarque Bera) Based on the probabilistic value of 2.112; It is greater than 1 percent, 5 percent, and 10 percent, and the regression estimate here follows the normal distribution.

Peseran & Peseran (1997) proposed the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of reqursive residuals (CUSUMSQ) tests in order to test the parameter stationarity. In the literature, the CUSUMSQ test is a much more sensitive test than the CUSUM test, therefore both test graph is given in the study. CUSUM and CUSUMSQ statistics are iteratively repeated and plotted against breakpoints. If the graph to be obtained as a result of the test remains within the limits of 5% significance, it can be said that the coefficient estimates are stable (Bahmani-Oskooee & Bohl, 2000). The results obtained from the CUSUMSQ test are given in Figure 3. It is possible to say that the model is stable since the graph consisting of the data within the scope of the analysis remains within the lower and upper limits at the 5% importance level. Test results show that the model is stable.

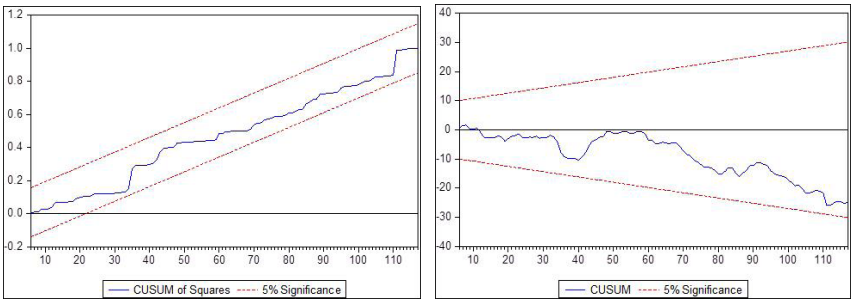

Figure 3. CUSUM and CUSUM Sq test results of model

4. Conclusion

In this study, I examined the impact of the Covid-19 pandemic (new deaths, new cases, recovering) and the crude oil price on developing country economic policy uncertainty. To achieve this goal, I applied the Autoregressive-Distribute Lag (ARDL) model to the daily data between 04.04.2020 and 16.09.2020 to measure the short-run and long-run effects on the EPU. This study is one of the pioneering studies examining the relationship between the covid-19 epidemic, crude oil price and economic policy uncertainty, which emerged in late 2019 and has been intensely felt all over the world since April 2020, specifically for developing countries. According to the results from the study, Covid-19 new cases and new deaths has long-run impact on economic policy uncertainty in Turkey. The results obtained from this study coincide with (Jeris & Nath, 2020) for UK, (Albulescu C., 2020) for US, (Altig et al. 2020) for US and UK, (Sun et al. 2020) for G7 countries. Moreover Brent crude oil price has negative and intense influence on economic policy uncertanity. This result is similar to the findings from (Jeris & Nath, 2020) for UK,

(Hailemariam 2019) for G7 countries. Additionally there is a strong short-run impact of all variables except recovering on economic policy uncertanity. The findings obtained reveal the dangerous effect of covid-19 pandemic and crude oil prices on economic policy uncertanity for decision makers.One of the most important results from the study is the increase of the EPU despite falling oil prices in an emerging country economy that is overly fragile due to its current account deficit and net oil importer like Turkey.This suggests that uncertainty caused by covid-19 clearly increases the EPU by dominating all other factors. For this reason, the Turkish government should be very careful about the measures it will take during the covid19 pandemia period. Shocks in the event of a reversal of falling oil prices could cause the impact of economic measures to disappear.The results from the study will give a new perspective to the researchers who want to study the subject. The limits of the study are as follows; the sampling period covers an extremely recent history, as it includes weekdays over a six-month period. If the study can be expanded with a longer timeframe and large data set in the future, it will contribute to a better understanding of the Covid-19 pandemic and the effects of the crude oil price in short-run and long-run.

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Conflict of interest

The author declare no conflict of interest in this paper.

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