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Araştırma Makalesi / Research Article

Oil Prices, Economic Policy Uncertainty and Stock Market Returns in Oil Importing Countries: The Impact of COVID-19 Pandemic

Çiğdem Kurt Cihangir[1], Şahnaz Koçoğlu[2]

Abstract

This study examines the nexus between oil prices, economic policy uncertainty and stock markets in a panel of selected major oil importing countries between June 2014 and October 2020. We analyzed China, India, Germany, Italy and Japan in the study because these countries are among the largest oil importer countries in the economic policy uncertainty index developed by Economics Policy Uncertainty Platform. We split the period into three sub-periods as June 2014- February 2016, March 2016-December 2019 and January - October 2020 and employed several econometric models to analyze the relation between the variables in different economic conditions and to identify how COVID-19 pandemic has influenced the effect of oil prices and economic policy uncertainty on the stock markets. Empirical results show that the pandemic changed the dynamics of the relations between the variables and especially the effect of oil prices on the stock markets has grown stronger for the oil importing countries.

Keywords: *Oil Prices, Economic Policy Uncertainty Index, Stock Markets, ARDL, COVID-19.*

Petrol İthalatçısı Ülkelerde Petrol Fiyatları, Ekonomik Politika Belirsizliği ve Hisse Senedi Pazarı Getirileri: COVID-19 Salgınının Etkisi

Öz

Bu çalışmada petrol fiyatları, ekonomik politika belirsizliği ve hisse senedi pazarları arasındaki ilişki büyük petrol ithalatçısı ülkeler için Haziran 2014 ile Ekim 2020 tarihleri arasında incelenmiştir. Çin, Hindistan, Almanya, İtalya ve Japonya'nın çalışma kapsamında analize dahil edilmelerinin nedeni, Economic Policy Uncertainty platformu tarafından geliştirilen ekonomik politika belirsizliği endeksindeki en büyük petrol ithalatçıları ülkeler olmalarıdır. Çalışma dönemi Haziran 2014- Şubat 2016, Mart 2016-Aralık 2019 ve Ocak - Ekim 2020 olarak 3 alt periyoda ayrılmıştır ve ekonometrik analizler kullanılarak değişkenlerin arasındaki ilişki farklı ekonomik koşullar altında değerlendirilmiştir. Özellikle KOVİD-19 salgını döneminde ilişkilerin nasıl değiştiğini analiz etmek amacıyla salgın dönemi ayrı tutulmuştur ve petrol fiyatları ile ekonomik politika belirsizliğinin hisse senedi piyasalarına etkisinde bir değişim gözlemlenip gözlemlenmediği ortaya konmaya çalışılmıştır. Ampirik sonuçlar, salgının değişkenler arasındaki ilişkilerin dinamiklerini değiştirdiğini ve özellikle petrol fiyatlarının borsalar üzerindeki etkisinin petrol ithalatçısı ülkeler için daha da güçlendiğini göstermektedir.

Anahtar Kelimeler: *Petrol Fiyatları, Ekonomik Politika Belirsizliği Endeksi, Hisse Senedi Piyasaları, ARDL, COVID-19.*

[1] Assoc. Prof. Dr., Hitit University, Faculty of Economics and Administrative Sciences, Department of Business Administration, kurt_cigdem@yahoo.com, https://orcid.org/0000-0003-1761-1038

[2] Corresponding Author (Sorumlu Yazar), Assist. Prof. Dr., Ankara Hacı Bayram Veli University, Faculty of Economics and Administrative Sciences, Department of Business Administration, sahnaz.kocoglu@hbv.edu.tr, https://orcid.org/0000-0002-2061-1242

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INTRODUCTION

The fiscal and monetary policies have influence over the prices in energy market through their effect on inflation, economic growth, total demand and supply (Calvo, 2020; Frankel, 2006). Posing threat to producers, consumers and investors, permanent changes in volatility of energy prices affects the economic performance and inflation (Kilian, 2008, 2009; Kilian & Hicks, 2013; Antonakakis et al., 2014). Therefore, we should better understand the effect of economic policy uncertainty (EPU) on energy markets to diminish information asymmetry in the market to control the spread of economic crises.

EPU affects the energy prices through three ways. Firstly, adversely affecting investment, macroeconomic policy uncertainties increase the cost of financing which may result in postponed investment decisions (Antonakakis et al., 2014; Kang et al., 2014; Wang et al., 2014). Secondly, changes in the energy market policies and regulations have direct influence over energy supply and demand (Phan et al., 2018). For instance, subsidy to encourage electric cars would decrease the demand for gasoline through decline in gasoline car demand. Thirdly, increase in EPU will cause risk-averse investors to delay or minimize their investments. The negative investor sentiment would contribute to the volatility in the market.

According to Zhang (2019), due to financial frictions and restraints EPU causes inefficiencies in the allocation of capital by affecting investor sentiment and stock returns. Chang et al. (2015) state that EPU usually worsens the effect of oil price shocks on the stock markets. Therefore, EPU is an indicator of investor sentiment in the energy market due to predictability of volatility and returns of oil (Tsai, 2017; Qadan & Nama, 2018).

Hamilton and Wu (2015) state that index and hedge fund managers have been increasing the percentage of energy commodities in the portfolios. Therefore, investors should foresee how the sentiment affects the oil prices to optimize their portfolio. The importance of this effect can be categorized under three groups (Qadan & Nama, 2018). Firstly, sharp changes have been observed in the oil market. Oil price per barrel was $145.85 in July 2008; and it declined to $115 in June 2014 and $25 in January 2016. Secondly, fall (increase) in the oil prices is related with positive (negative) economic growth and increase (decrease) in stock returns according to numerous studies (Aloui et al., 2016; Arora & Lieskovsky, 2014; Kilian, 2009). Thirdly, with the financialization of commodity markets, crude oil turned out to be a strong factor in the determination of stock market returns.

The financialization of crude oil also increased the volatility in oil prices, which is usually the result of changes in demand and supply or common shocks like 2008 Financial Global Crises. And COVID-19 created a shock wave so powerful it resulted in a stock market crush in March 2020. Pandemic has not only affected businesses, job security and essential services because of the lockdowns and restrictions, but it has also caused the sharpest decline in oil demand since its acceptance as a global commodity (Sharif et al., 2020).

With the declaration of COVID-19 as pandemic by WHO on March 2020, corona virus has been at the top of the world's agenda. The societies and the economies are going through unprecedented changes and the dynamics in relations between financial and economic factors shall be redefined considering the dramatic effect of COVID-19 in every aspect of life. As stated by Baker et al. (2020), COVID-19 pandemic is not like the previous pandemics with regard to its extraordinary effect on the US stock market and a deeper understanding of the impact on the financial markets is crucial. Only a few studies about the effect of COVID-19 on the economy and

financial markets have recently been conducted, many more will be published soon though. He et al. (2020) profound the negative impact of COVID-19 on the stock markets. In addition to the stock markets, the economic policy uncertainty and the geopolitical risk of US are sensitive to oil price shocks and corona according to the study of Sharif et al. (2020). Salisu et al. (2020) analyze 15 countries affected by COVID-19 and state that shocks in the stock markets and oil prices during the pandemic will be due to the uncertainties in the financial markets. Although the dramatic impact on the stock markets might be due to overreaction (Phan & Narayan, 2020), there is still too much uncertainty about how the relations between financial and economic factors change during the pandemic.

In this study, we analyze the link between stock returns, oil prices and the investor sentiment. Baker et al. (2016) suggest EPU Index as an indicator to measure investor sentiment and we use EPU to represent investor sentiment. EPU successfully represents the uncertainties in economic policy as it is not affected by politically biased newspapers and reveals strong correlation with other uncertainty indicators (Antonakakis et al., 2014; Baker et al., 2016; Balcılar et al., 2016; Tsai, 2017). Wei et al. (2017) argue that EPU incorporates all the information offered by traditional indicators and EPU is a better indicator to foresee the volatility of crude oil compared to other factors for example global oil demand and supply and speculation.

This study has two specific purposes. Firstly, we examine how oil prices and national EPU indices have impact over the stock markets of selected oil importing countries. Secondly, we identify the changes in the relation over different periods. Therefore, we identify three periods as June 2014- February 2016, March 2016-December 2019 and January - October 2020. We included China, India, Germany, Italy and Japan as oil importing countries in the study because the Economic Policy Uncertainty Platform (policyuncertainty.com) has been constructing national EPU index for these countries and selected countries are among the top economies in the world with enormous amount of oil consumption. Although considerable amount of studies exit about the relation of stock market performance, EPU index and oil prices, this study will contribute to the literature by creating an idea of how this relationship has changed during the pandemic.

1. LITERATURE REVIEW

Several studies have analyzed the relationship between oil prices and stock markets in the literature. While most of these studies report that this relationship is negatively correlated (Jones & Kaul 1996; Sadorsky, 1999; O'Neill et al., 2008; Driesprong et al., 2008; Kilian & Park, 2009; Filis, 2010), a great deal of studies argues otherwise (Narayan & Narayan, 2010; Zhu et al., 2016; Silvapulle et al., 2017) or reveal no significant relationship (Huang et al., 1996; Apergis & Miller, 2009; Miller & Ratti, 2009; Hatemi-J et al., 2017). These conflicting results may be due to heterogeneity in the level of oil dependence across countries (Mohanty et al., 2011; Smyth & Narayan, 2018) or several transmission channels between oil price changes and stock markets returns (Degiannakis et al., 2017). For example, for oil-importing countries, any oil price increase will lead to higher cost of production because oil is one of the most important production factors (Arouri & Nguyen, 2010; Backus & Crucini, 2000) and consequently, stock markets would react negatively (Sadorsky, 1999; Jones & Kaul, 1996).

Degiannakis et al. (2017) state theoretical transmission mechanisms between oil and stock market returns, highlighting five different channels: the stock valuation channel, monetary channel, output channel, fiscal channel, and uncertainty channel. In the stock valuation channel,

changes in oil prices affect the firm's future cash flows. This effect can be positive or negative depending on whether the firm is a producer or user of oil (see Oberndorfer, 2009; Mohanty et al., 2011). In the monetary channel oil price changes influence the expected discount rates of future cash flows through inflation and interest rates (Mohanty et al., 2011). According to the output channel, in particular, an increase in oil prices is expected to have both an income and a production cost effect, which will result in changes in total output. This mechanism particularly holds for oil-importing economies. The fiscal channel is mainly concerned with oil-exporting economies, which are financing infrastructure investments using their oil revenues. The final transmission channel is the uncertainty channel (Brown & Yücel, 2002). The value of deferred investment and consumption decisions rises because uncertainty rises due to increased oil prices. As a result, motivation for investment and consumption decreases. Thus, economic growth prospects get worse together with (Chuku et al., 2010) stock market returns. As the uncertainty in the oil market increases, the oil prices fluctuate more widely (Okorie & Lin, 2020). This risk will affect the financial decisions such as production, consumption, purchases etc. of investors or financial institutions.

Recent studies have examined how economic policy uncertainties affect the economy through different channels. Part of the literature analyzes the EPU's impact on firm-level investment behavior. Bloom (2009) finds that higher uncertainty brings about firms to temporarily pause their investment and hiring. Kang et al. (2014) find investment decisions of companies are negatively affected by economic policy uncertainty and firm-level uncertainty.

A second strand of the literature analyzes the linkage between asset markets and the EPU. Antonakakis et al. (2014) examine policy uncertainty and US stock market returns and conclude that except the US sub-prime crisis, relationship between stock returns and EPU is continually negative between 1985 and 2013. Pastor and Veronesi (2013), Chang et al. (2015), Sum (2012), Brogaard and Detzel (2015) also find that policy uncertainty reduces asset returns. Pastor and Veronesi (2013) find that policy uncertainty index creates a risk premium, and that stocks are more volatile when uncertainty increases. Chang et al. (2015) research for selected OECD countries whether EPU is correlated to stock markets over the period between 2001.01 and 2013.04 by bootstrap panel causality test. Results propose that the causality from stock prices to EPU is significant in the UK and USA. Furthermore, the authors report that volatility in the USA and UK economic policies causes stock prices to reduce and that the EPU also influences oil prices in the USA. Arouri and Roubaud (2016) examine the link between EPU and stock markets in China, India and the USA between 2003 and 2014. Their findings suggest that contrary to China, an increase in EPU in the USA and India reduces stock returns significantly and augments market volatility. Gürsoy (2021a) examined the relation between Global Economic Policy Uncertainty Index and Istanbul stock exchange along with inflation, Dollar/Turkish Lira and Euro/Turkish Lira in Turkey. He concludes that GEPU has positive causal effect over exchange rates but there is no impact on the other variables.

Another strand of the literature analyzes the interplay between the EPU and oil prices, along with some other economic indicators. Gürsoy (2021b) states that geopolitical risk has impact over oil prices and economics policy uncertainty stands as another risk factor affecting the oil prices. Kang and Ratti (2013) investigate the relationship between structural oil shocks, EPU and real stock returns with structural VAR model from 1985:1 to 2011:12. They find that oil shocks and EPU are interrelated and affect stock returns in the USA. Also, they determine that an unexpected increase in the EPU causes a decrease in real stock returns. Antonakakis et al.

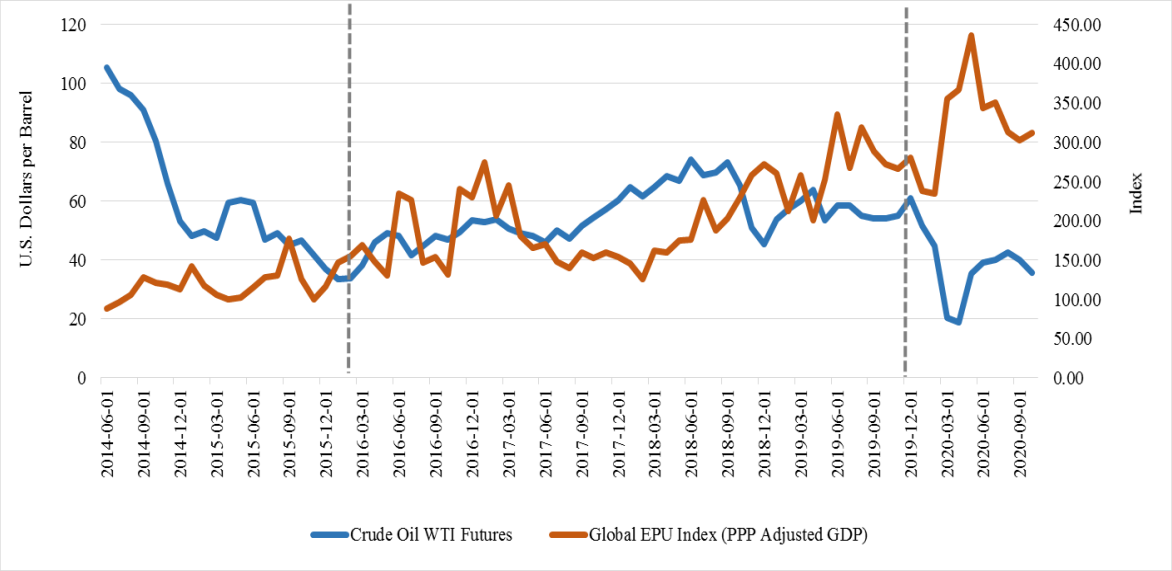
(2014) argue that the EPU index is related to structural oil price shocks. A similar result is also propsed by Arouri et al. (2014). Accordingly, EPU negatively influences stock returns and that the impact is affected by the oil price changes. Aloui et al. (2016) analyze the impact of uncertainty on oil returns and they find that an increase in EPU indices also increased oil returns preceding the financial crisis.

2. METHODS AND EMPIRICAL FINDINGS

2.1. Data

To analyze the impact of oil prices and EPU indices on the stock markets of oil importing countries, Economic Policy Uncertainty Index (www.policyuncertainty.com) and Crude Oil WTI Futures prices (www.investing.com) were used over the period June 2014 and October 2020. China, India, Japan, Italy and Germany, which are major oil importing countries, and whose National EPU Indices are measured, are included in the study. Being among the top oil importing countries, data for stock market price indices of China (Shanghai Composite), India (Nifty 50), Japan (Nikkei 225), Italy (FTSE MIB) and Germany (DAX) and Crude Oil WTI Futures prices was compiled from investing.com (2020) (https://www.investing.com/). To identify the evolution of relations and impacts, the period was split into three sub-periods. Figure 1 reveals the relation between oil prices and Global EPU Index visually in the analysis period.

Figure 1. Crude Oil WTI Futures and Global Economic Policy Uncertainty (EPU) Index Values (PPP) between June 2014 and October 2020



Source: Data for oil prices from Investing.com (2020) and for GEPU Index (PPP) from https://www.policyuncertainty.com (2020).

In the first period covering June 2014 and February 2016, the oil prices fell steadily from mid-2014 to early 2016 and Global EPU Index rose by almost 75% due to negative economic expectations. Between March 2016 and December 2019, the Global EPU Index moderately rose compared to other periods and oil prices almost recovered its previous losses due to Bullish

sentiment in the markets. Starting from January 2020, the world acknowledged that COVID-19 would be the most dangerous pandemic of the modern times. Due to lock downs and panic all around the world, industrial production was almost completely halted in the biggest economies. Oil prices slumped because of the deep fall in demand and Global EPU Index increased dramatically in an economic environment surrounded by uncertainties. Figure 3 reveals the relation of the national EPU indices of China, Japan, India, Italy and Germany with the oil prices form June 2014 to October 2020.

The purpose of this study is to analyze the relation between oil prices, EPU index and stock market returns under these different economic and social conditions by using various econometric methods. To examine how the change in oil prices and EPU affect the stock returns of oil importing countries, we take the difference of pooled series as follows:

$$\Delta Stock = \frac{Stock\ Price\ Index_{i,t+1} - Stock\ Price\ Index_{i,t}}{Stock\ Price\ Index_t}$$

$$\Delta Oil\ Prices = \frac{Oil\ Price_{i,t+1} - Oil\ Price_{i,t}}{Oil\ Price_t}$$

$$\Delta EPU = \frac{EPU\ index_{i,t+1} - EPU\ index_{i,t}}{EPU\ index_{i,t}} \quad (1)$$

where *t* and *i* represent time and country, Stock is the stock price indices of China, India, Japan, Italy and Germany; Oil is the Crude Oil WTI Futures in USA Dollar; EPU is the national EPU Index calculated for each country in the analysis.

2.2. Unit Root Process

As a preliminary test, we examined the time series properties of the panel data by panel unit root tests. To test for stationarity of the data, LLC Test by Levin, Lin and Chu (2002), Fisher ADF test and Fisher PP test by Maddala and Wu (1999) and Choi (2001), Breitung t test proposed by Breitung (2000) were conducted for two different models namely Individual Intercept and Individual Intercept and Constant. Table 1 presents the results of unit root test for stock markets indices, oil prices and EPU. In the first period, both changes in stock market indices of oil importing countries and changes in the national EPU indices have unit root at level and are integrated at the first difference at 10% significance. Changes in oil prices series is stationary at I(0) but 5 out of 9 tests show that the series is stationary at its first difference at 5% significance. In the second period, all series are stationary both at level and at first difference. In the third period, 3 unit root tests suggest that stock market indices series have unit root at I(0) and the series is stationary at its first difference based on the results of 6 tests at 10% significance. Oil prices indices show both stationary and nonstationary characteristics at level but it is integrated at I(1) at 10% significance. For the EPU series, 7 and 6 tests prove that the series is stationary at level and at first difference respectively at 5% significance. ARDL approach is suitable for data integrated at I(0) or I(1) but not at I(2) and the all series in this analysis fit for ARDL method.

Table 1: Unit Root Test Results

	Levin, Lin & Chu		Im, Pesaran and Shin W-stat		ADF - Fisher Chi-square		PP - Fisher Chi-square		Breitung t-stat
	Individual Intercept	Individual Intercept and Constant	Individual Intercept	Individual Intercept and Constant	Individual Intercept	Individual Intercept and Constant	Individual Intercept	Individual Intercept and Constant	Individual Intercept and Constant
Test in level									
ΔStock	*-3.09854****	*-4.12252****	*-2.61238****	*-2.93125****	*23.0435***	*25.5927****	*34.1935****	*49.1489****	*-2.06822***
ΔOil	*1.46237*	*2.79034*	*-0.89822*	*0.20635*	*11.2853*	*6.54155*	*31.6537****	*21.8887***	*-3.54483****
ΔEPU	*-4.70964 ****	*-3.99508 ****	*-5.37751 ****	*-3.73355 ****	*46.2775 ****	*31.5487 ****	*126.953 ****	*91.4127 ****	*-1.54986 **
Test in First Difference									
ΔStock	*-5.84928****	*-4.21750****	*-6.22819****	*-4.66575****	*53.3577****	*38.3922****	*251.836****	*91.3236****	*-4.35955****
ΔOil	*-0.32170*	*1.44235*	*-2.60474****	*-0.89651*	*22.8595***	*11.9941*	*100.380****	*78.7166****	*-3.30458****
ΔEPU	*-6.28896 ****	*-4.81718 ****	*-7.55434 ****	*-6.19646 ****	*64.6815 ****	*49.8772 ****	*748.709 ****	*87.1980****	*-6.10652 ****
Second Period									
Test in level									
ΔStock	*-6.37995****	*-5.02496****	*-8.81976****	*-7.62650****	*88.1495****	*68.5408****	*169.557****	*158.929****	*-7.48477****
ΔOil	*-5.94709****	*-4.33584****	*-9.11466****	*-7.83728****	*92.1034****	*70.0487****	*127.035****	*103.394****	*-3.28796****
ΔEPU	*-11.9357 ****	*-11.1144 ****	*-12.3734 ****	*-11.4585 ****	*131.464 ****	*110.797 ****	*170.900 ****	*743.259 ****	*-6.78684 ****
Test in First Difference									
ΔStock	*-11.3754****	*-8.91977****	*-18.4556****	*-17.8930****	*187.514****	*221.836****	*115.632****	*1217.18****	*-10.2124****
ΔOil	*-7.92671****	*-5.53340****	*-15.3068****	*-14.6182****	*164.316****	*150.045****	*92.1034****	*1316.95****	*-7.81506****
ΔEPU	*-16.6357 ****	*-15.6439 ****	*-19.0842 ****	*-18.6511 ****	*192.929 ****	*232.772 ****	*92.1034 ****	*1316.95 ****	*-5.31235 ****
Third Period									
Test in level									
ΔStock	*-11.7154****	*-6.27101****	*-4.64349****	*-0.55944*	*41.8114****	*17.0083**	*19.6573***	*7.64787*	*1.03536*
ΔOil	*-17.3818****	*-13.3556****	*-7.06488****	*-1.75479***	*58.7081****	*32.0200****	*10.4149*	*2.08212*	*-1.05931*
ΔEPU	*-8.25019****	*-12.8297****	*-2.64737****	*-1.19575*	*26.9282****	*22.2511***	*25.4444****	*26.9433****	*1.82948*
Test in First Difference									
ΔStock	*-2.04542***	*3.04267*	*-1.42108**	*0.17080*	*18.7541***	*8.46181*	*35.0601****	*64.7872****	*-1.50803**
ΔOil	*-9.73065****	*-12.1344****	*-3.53112****	*-1.37199**	*34.7616****	*27.4473****	*24.8173****	*50.1666****	*-18.2765****
ΔEPU	*-7.47816****	*-2.42488****	*-2.82758****	*-0.28447*	*27.2525****	*14.2438*	*55.2326****	*57.7691****	*-0.05155*

*,**,*** represents significance at 1%, 5% and 10% levels

2.3. Panel Cointegration Analysis

The long run relation between the variables is analyzed with cointegration analysis of Pedroni (1996) for three periods. Pedroni (1996) test suggests 11 tests and 8 of them are within dimension and three of them are between dimensions. The test is specified as follows:

$$\Delta Stock_{it} = \alpha_i + \mu_i t + \delta_{ij} \Delta X_{i,t} + \epsilon_{it} \quad (2)$$

i and t represents the oil importing countries in the analysis and time respectively in the pooled data; X represents oil prices and EPU for each analysis. After finding the residuals based on that equation, the residuals are tested by the following equation:

$$\epsilon_{it} = \rho_i \varepsilon_{it-1} + \upsilon_{it} \quad (3)$$

Table 2 presents the Pedroni (1996) test results for all periods. Pedroni Residual Cointegration test provides 11 tests in which 8 of them are within dimension and 3 of them are between dimension. In the first period, 8 tests suggest that there is cointegration between oil prices and stock market indices. There is also cointegration between national EPU indices and stock market returns based on 7 tests at 10% significance. In the second period, 9 test results prove that there is strong cointegrating relation of stock market indices with both oil prices and national EPU indices. There is cointegration between stock market indices and oil prices in the third period based on 6 tests out of 11 while 6 test results do not reject the null hypothesis of no cointegration between stock market indices and national EPU indices.

Table 2: Pedroni Residual Cointegration Test Results

	Oil-Stock Relation			**EPU-Stock Relation**		
	Panel (within dimension)		**Group (between dimension)**	**Panel (within dimension)**		**Group (between dimension)**
First Period						
		Weighted			**Weighted**	
v-Statistics	*-2.646600*	*-2.716628*		*-2.897680*	*-2.761492*	
rho-Statistics	*-1.834451***	*-1.388115**	*-0.346304*	*-1.449870**	*-1.264574*	*-0.263113*
PP-Statistics	*-5.266320****	*-5.383346****	*-7.609173****	*-5.559170****	*-6.485837****	*-12.85958****
ADF-Statistics	*-3.697000****	*-4.560277****	*-4.736118****	*-4.088802****	*-4.790849****	*-4.926949****
Second Period						
		Weighted			**Weighted**	
v-Statistics	*0.843022*	*-0.807384*		*-0.668439*	*-1.821739*	
rho-Statistics	*-17.10079****	*-14.44934****	*-11.62523****	*-16.54241****	*-12.88404****	*-10.97795****
PP-Statistics	*-17.81854****	*-15.55245****	*-17.17383****	*-17.47956****	*-14.34718****	*-16.50317****
ADF-Statistics	*-8.737719****	*-7.729398****	*-8.512404****	*-8.380324****	*-7.834260****	*-8.263276****
Third Period						
		Weighted			**Weighted**	
v-Statistics	*-1.797025*	*-2.558666*		*-2.039787*	*-2.276731*	
rho-Statistics	*-0.737284*	*0.172909*	*0.842761*	*0.555512*	*0.552008*	*1.414595*
PP-Statistics	*-13.19063****	*-11.09524****	*-16.58573****	*-3.284669****	*-3.740844****	*-4.246500****
ADF-Statistics	*-4.553154****	*-5.551763****	*-5.016768****	*-2.553596****	*-1.960640***	*-1.219400*

Trend assumption is deterministic intercept and trend. *, **, *** represents significance at 1%, 5% and 10% levels

2.4. Panel ARDL Analysis

For Panel Autoregressive Distributed Lag Models, pooled mean grouped (PMG) estimator by Pesaran, Shin and Smith (1999) is used to both consider long run and short run relation between the variables. The panel ARDL model used in this study is:

$$\Delta Stock_{it} = \mu_i + \sum_{j=1}^{p} \beta_{ij} \Delta Stock_{i,t-1} + \sum_{j=0}^{q_1} \delta_{ij} \Delta X_{i,t-1} + \epsilon_{it} \quad (4)$$

Here i and t represents the oil importing countries in the analysis and time respectively, j is the number of lags, Stock is the stock price index of the countries, β_{ij} is the coefficient for lags of Stock variable, δ_{it} is coefficient vectors for Oil and EPU indices respectively, Oil is the Crude Oil WTI Futures prices in USA Dollar, EPU is the national EPU Indices

The reparametrized ARDL error correction model can be specified as

$$\Delta(\Delta Stock)_{it} = \mu_i + \theta_i\left(\Delta Stock_{i,t-1} - \theta_1 \Delta X_{i,t-1}\right) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta(\Delta Stock)_{i,t-1} + \sum_{j=0}^{q_1-1} \lambda'_{ij} \Delta(\Delta X)_{i,t-1} + \epsilon_{it} \quad (5)$$

θ_1 is long run coefficient while λ_{ij}, λ'_{ij} are short run coefficients for oil price and economic policy uncertainty indices; X represents oil prices and economic policy uncertainty index for each analysis.

Table 3 reveals the ARDL analysis for both short run and long run relation of stock market returns with oil prices and their national EPU indices. In the first period, oil prices have strong long term and short-term effect on the stock market indices. While the long-term effect of oil prices is positive, the short run effect is negative. Error correction term is -1.40 which is both negative and statistically significant. ECT suggests that any shock to the long-term equilibrium is adjusted promptly. National EPU of the countries have negative long-term impact on the stock market returns in the first period. The ECT, negative and statistically significant, reveals that short-term disparity from the long run equilibrium is adjusted by 79% between EPU and stock market indices. In the second period, the oil prices have no long-term effect but there is positive short-run effect on the stock market indices. The effect of national EPU on the stock market returns in the second period is negative both in the short and long run. The error correction terms for both models in the second period is negative, statistically significant and less than 1. Error correction terms for the second period imply immediate adjustment from short-term equilibrium to long-term equilibrium. During the COVID-19 Pandemic, the long term effect of oil prices turns from negative to positive in the long-term while no short term effect is detected. -1.22 ECT term indicates that any shock in the short run is adjusted quickly. The effect of EPU index on the stock market returns is negative in the long-run during the pandemic. The ECT suggests that any short-term shock to the system is restored by 79%.

Table 3: PMG ARDL Relation Results

	Results for oil-stock analysis				**Results for EPU-stock analysis**		
	First Period	**Second Period**	**Third Period**		**First Period**	**Second Period**	**Third Period**
Long Run				**Long Run**			
ΔOil Prices	*-58.50648*** *(10.57306)* *[-5.533543]*	*-8.134033* *(5.948646)* *[-1.367375]*	*85.51985*** *(7.323987)* *[11.67668]*	**ΔEPU**	*-3.829593** *(2.262452)* *[-1.692673]*	*-0.344702** *(0.184628)* *[-1.867008]*	*-9.855297*** *(0.648569)* *[-15.19544]*
Short Run				**Short Run**			
ECT	*-1.400776*** *(0.246318)* *[-5.686861]*	*-1.145216*** *(0.066297)* *[-17.27409]*	*-1.228382*** *(0.343067)* *[-3.580590]*	**ECT**	*-0.791928*** *(0.083701)* *[-9.461336]*	*-1.127467*** *(0.049335)* *[-22.85325]*	*-0.796854*** *(0.255564)* *[-3.118027]*
ΔOil Prices	*54.68371*** *(19.25458)* *[2.840036]*	*41.21593*** *(14.72203)* *[2.799610]*	*-12.73382* *(14.23603)* *[-0.894478]*	**ΔEPU**	*-3.278837* *(3.402053)* *[-0.963782]*	*-2.048308** *(0.993686)* *[-2.061322]*	*-2.429089* *(5.710912)* *[-0.425342]*
ΔOil Prices(-1)	*71.07435*** *(19.70296)* *[3.607293]*	*47.69359*** *(18.27585)* *[2.609651]*		**ΔEPU (-1)**	*-7.377720* *(6.345548)* *[-1.162661]*		
ΔOil Prices (-2)	*87.80299*** *(19.30727)* *[4.547664]*	*28.65921*** *(7.648013)* *[3.747275]*		**C**	*-0.363295* *(39.78557)* *[-0.009131]*	*104.9615*** *(31.35950)* *[3.347040]*	*67.37345* *(65.82744)* *[1.023486]*
ΔOil Prices(-3)	*51.16799*** *(14.11525)* *[3.625015]*	*31.05033*** *(9.572182)* *[3.243809]*					
C	*-276.2521*** *(41.53978)* *[-6.650304]*	*112.7341*** *(38.28707)* *[2.944444]*	*31.50943* *(144.0242)* *[0.218779]*				
Selected Model	ARDL (3,4)	ARDL(1,4)	ARDL(1,1)				
					ARDL(1,2)	ARDL(1,1)	ARDL(1,1)

() Standard errors, []t statistics, *, **, *** represents significance at 1%, 5% and 10% levels, *Akaike's information criterion (AIC) is the Model selection method;* the lag selection for the final period is selected *ARDL (1,1)* because of the limited amount of data.

2.5. Granger Causality Test

Finally, the relationship between stock markets of oil importing countries, economic policy uncertainty levels and oil prices are examined with Granger Causality test proposed by Granger (1969). For the variables cointegrated in the long-run, Vector Error Correction model better fits in Granger Causality analysis. For that purpose, for all the models and period, VEC Granger causality test is employed except for the analysis between changes in EPU and Stock market returns in the third period as these two variables are not cointegrated in the long-run. The VAR Granger causality test is preferred for the analysis between EPU and stock market indices in the third period. Table 4 presents the results for all the periods. In the first and second period, there is unidirectional causal relation between oil prices and stock market indices. In the third period, there is only one causality relation between the variables and oil prices cause the stock market indices of oil importing countries. There is only one causal relation between changes in EPU index and stock market returns and it is the second period in which stock market returns causes the national EPU indices.

Table 4: Granger Causality Test Results

Dependent Variable	Independent Variable	Chi-Sq
First Period		
ΔStock	ΔOil	*26.95021**** *(0.000)* *[8]*
ΔOil	ΔStock	*104.2525**** *(0.000)* *[8]*
ΔStock	ΔEPU	*1.744979* *(0.6270)* *[3]*
ΔEPU	ΔStock	*7.238958** *(0.0647)* *[3]*
Second Period		
ΔStock	ΔOil	*39.75031**** *(0.000)* *[4]*
ΔOil	ΔStock	*18.20817**** *(0.000)* *[4]*
ΔStock	ΔEPU	*0.003324* *(0.9540)* *[1]*
ΔEPU	ΔStock	*6.431852*** *(0.0112)* *[1]*
Third Period		
ΔStock	ΔOil	*14.96252**** *(0.000)* *[2]*
ΔOil	ΔStock	*2.210307* *(0.3312)* *[2]*
ΔStock	ΔEPU	*0.284512* *(0.8674)* *[2]*
ΔEPU	ΔStock	*0.741676* *(0.6902)* *[2]*

*,*,*** represents significance at 1%, 5% and 10% levels, () probabilities, []Lag Selection based on Akaike's information criterion (AIC), The lag selection for the final period is selected 2 because of the limited amount of data.

3. CONCLUSION AND DISCUSSION

In this study, we employed Pedroni (1996) cointegration test, PMG ARDL test by Pesaran, Shin and Smith (1999) and Granger causality test to analyze the effect of change in oil prices and economic policy uncertainty on the stock market returns of oil importing countries. Sample countries include China, India, Germany, Italy and Japan. To identify the dynamics of the relation under different economic and social conditions; we conducted the analysis for three sub-periods, which we determined based on the fluctuations in oil prices.

In the first period between June 2014 and February 2016 (21 months), global EPU index rose by almost 75% while oil prices decreased from 105.37$ to 33.75$. In this period, stock market returns of oil importing countries have cointegration with both changes in oil prices and national EPU indices. PMG ARDL analysis suggests that changes in oil prices have negative effect on the stock market returns in the long run. Changes in oil prices have also positive short-term effect on the stock market indices (Narayan &Narayan, 2010; Silvapulle et al. 2017) but EPU does not affect the stock markets of oil importing countries in the both short run and long run. Granger causality test revealed bidirectional causality between stock market returns of oil importing countries and oil price changes. These results should be analyzed within the context of the economic and social conjecture of the period. The excess supply of oil (Ellwanger et al., 2017) and a negative bubble in oil prices which cannot be explained by economic conditions (Fantazzini, 2016) appear as the dominant factors behind the sharp fall in the oil prices. When the fall in the oil prices is not the consequence of worsening economic conditions and diminishing demand, the oil importing countries can take advantage of declining oil prices. The results of our study support these arguments and we show that the declining oil prices had positive impact on the stock market returns of oil importing countries in the long run.

The second period between March 2016 and December 2019 can be characterized as relatively less volatile since the Global EPU Index increased by 66% considering the fact that the analysis covers 46 months. The free fall of oil prices ceased in this period and the price was up almost 60%. Strong cointegration relation was detected between the variables while PMG ARDL test shows that neither change in EPU nor in oil prices had impact over the stock market returns in the long run. This might be due to the fact that no economic and financial turmoil in this period and positive economic expectations might mitigate the strong impact of oil prices on the stock market indices in the long run. In the short run, we found positive impact of oil price (Narayan & Narayan, 2010; Silvapulle et al., 2017) and negative impact of EPU on the stock market indices. These findings support Liu and Zhang (2015) who argue that higher EPU rises the stock market risk. Similar to the results of the first period, we detected bidirectional causality between oil prices and stock market indices of the oil importing countries while stock market returns are cause of EPU indices in the oil importing countries. The changes in stock market returns signal the changes in national EPU indices in oil importing countries during the period.

In the third period, the ongoing COVID-19 pandemic emerges as the most important factor influencing all aspects of social and economic life and we proved that the nature of relation between changes in oil price, EPU and stock market returns also changed. EPU has no cointegration relation with stock market indices of selected oil importing countries. While EPU has negative impact in the long, no short run effect is found on the stock market indices. An interesting result is that the fall in the oil prices had negative and strong effect on the stock market indices in long run. Our findings support the argument that oil is not used to hedge against stock market decline (Bouoiyour et al., 2017) when the shock is driven by pessimistic

economic expectations. The causality test results show that there is only one unidirectional causality from oil prices to stock markets. This results support the significant impact of oil prices on the stock market indices of oil importing countries. The findings of causality test comply with the study of Sharif et al. (2020) that oil price appears as having the strongest impact on the US stock market compared to EPU and other factors during the COVID-19 pandemic.

Overall, according to our short-term findings, there is a positive and statistically significant relationship between stock prices and oil prices in two sub-periods except for the COVID-19 period. This result is contrary to theoretical expectations. The reasons for this finding can be listed as follows: firstly, the effect of internal and domestic factors on these stock market returns may be more dominant than the oil price. Secondly, foreign fund managers or domestic investors might tend to invest in the stock market. Finally, the impact of other substitutable energy sources, such as coal and natural gas, might be more dominant than the oil. One implication for the investors is that the relation between oil prices and stock markets of oil importing countries change with the main driver behind the oil price shock. In the third period, the fall in the oil prices was driven by the negative economic expectations in the global markets and the effect on the stock markets was negative accordingly. Another implication is that the investors should be aware that the uncertainties in the economic policy of one country negatively affect the stock market and the risk also rises in the stock exchange of the country.

The study contributes to the literature by offering insights into how the effect of oil prices and economic policy uncertainty on the stock market returns of oil importing countries under different economic conditions. However, some limitations should be noted. Firstly, the analysis for the third period is conducted with limited amount of data. For future studies, the impact of COVID-19 on the nexus can be analyzed by including the oil exporting countries for comparison. Moreover, whether the stock market returns of the related countries have different sensitivity to changes in oil prices might be looked upon. In this way, a risk diversification opportunity / strategy can be determined. The econometric methods applied in this article can be used to measure the effect of alternative energy commodities, such as natural gas and coal, on related stock market returns.

AUTHOR STATEMENT

Statement of Research and Publication Ethics

This study has been prepared in accordance with the ethical principles of scientific research and publication.

Ethics Committee Approval

Ethics Committee Approval" is not required for the research.

Author Contribution

The authors contributed equally to the study.

Conflict of Interest

There is no conflict of interest for the authors or third parties arising from the study.

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