Jinnah Business Review
Jan 2023, Vol. **11**, No. 1, pp. 34-46

Asymmetry in Oil Price Shocks Effect Economic Policy Uncertainty? An Empirical Study from Pakistan

M. Waqar1[1], H. Zada*[2], A. Rafi[3], A. Artas[4]

[1,2,3,4] *SZABIST Islamabad, Pakistan*

Abstract. This study aims to explore the asymmetry in oil price shocks and its effect on the economic policy uncertainty of Pakistan using NARDL model. The findings reveal a long-run equilibrium relationship between the economic policy uncertainty and oil price shocks. Moreover, the findings show the asymmetric relationship between oil price shocks and economic policy uncertainty in the short and long run. The findings are important for investors looking to invest in Pakistan and the policymakers and regulators.

Key words: Oil-price-shocks; Non-linear ARDL; Asymmetric NARDL; Economic policy uncertainty

1 Introduction

Economic policy uncertainty (EPU) is an indicator of investors' confidence in an economy which can be influence by many factors, including oil price shocks (OPS). The economy of any country is significantly effected by fluctuations in crude oil prices that can cause a shift in cost of production, import receipts, and retail price of oil products. Any upsurge in the cost of production further leads to a decline in productivity, economic cost pulls inflation, decreasing consumption, and overall hampers the economic growth of a country (Afza and Nazir, 2014). Furthermore, Pakistan imports the majority of its oil and heavily relies on oil for production of non-renewable electricity. It can create a direct relation among OPS and electricity costs. Increases in oil prices affect macroeconomic factors such as the balance of payment, employment level, consumption, and investment (Afza and Nazir, 2014). There is a positive association among oil consumption with growth in economy. However there is negative association between OPS with oil consumption, indirectly causing a negative relationship among OPS with economic growth (Afza and Nazir, 2014). Since oil is among the largest sources of energy in Pakistan, its shocks have a direct relation with electricity prices contributing to the overall inflation index in Pakistan.

OPS come from the disturbance in the demand or supply of oil which at times can be due to political, social, environmental, economic, or legal reasons. An example of such an event that disturbed oil prices is the 11 September attacks on the World Trade Center; the financial market

*Corresponding author.
Email: hassanzaada@gmail.com

crashed, and along with that, the oil prices crashed by 20% as compared to before (Synergen, 2020). Another such example is the recovery phase of the great recession in 2014, where prices shot up from $100 to 125$ per barrel. A major unforeseen event that affected the oil price was the COVID-19 pandemic, where per barrel oil prices dropped to USD 19.20 (Synergen, 2020). The most recent political event that shook the oil prices was the Russia and Ukraine war. Oil prices rose to over $110 per barrel on 4 March 2022 from 76$ at the start of January 2022 (Bank, 2017). These and other events have made a significant contribution to the OPS, demonstrating that the impact of the OPS on the economy must be investigated.

OPS have a significant impact on a country's economic performance; therefore, it is critical to examine the association between OPS and economic indicators.. One indicator of an economy's future performance is the EPU index. It measures the irreversible risk for investors in a country and predicts adverse economic consequences caused by the uncertainty of policies. A high economic policy index indicates the breaking confidence of the investor in the government and increasing uncertainty of policies and regulations regarding businesses. A high economic policy uncertainty further leads to lower credit financing by the bank, impacting the level of investment in the economy (Wen et al., 2021). As a result, it is critical to identify the variables that cause variation in the EPU index, one of which is the oil price shock in Pakistan.

An increase in the EPU index leads to a decrease in corporate investment and borrowing, which increases the uncertainty in a country's economy (Al-Thaqeb et al., 2022). Apart from this, there is also a decrease in household spending furthermore reduces the aggregate demand, adversely impacting economic growth. Because of its importance, it is vital to determine the factors that fluctuate the index. One possible factor impacting EPU is the OPS which the following research will further determine. A quantitative analysis of the relationship between OPS and EPU can help policymakers in Pakistan take proactive measures to reduce the adverse impact of OPS on the EPU index. Although previous researches have been done on OPS and its impact on EPU, there has been limited work done in the domain of Pakistan to assist Pakistani policymakers. The research aims to determine the asymmetric (positive-negative) relationship of OPS and EPU. In light of the above research objectives, the following question will outline the scope of the research: Do OPS have a different impact on the EPU index in both the short and long run in Pakistan? This study is an attempt to provide insights of positive/negative shocks in the prices of oil and how its influnces the economy of Pakistan. The findings of this study is very important for the policymakers and regulators of Pakistan to formulate verious important policy for Pakistan economy to control any adverse effect of changes in oil prices for smooth functioning of the economy of Pakistan.

The rest of the paper is outline as: Section 2 comprises of previous studies on current topic. Section 3 discusses the methodology used in this paper. Section 4 provides empirical results. Section 5 discusses the study findings inlights of previous literature. whereas the last section concludes the study.

2 Literature Review

An asymmetric effect occurs when the impact of a change in the variable is not the same for all the sectors or regions uniformly distributed. When there is an asymmetric effect, the degree of changes of x variables on y variables is not the same when x increases as when x drops. The asymmetric result of economic activity to the changing in oil price innovation can eventually lead to the reallocation of capital from declining to the expanding sectors, so there

are prominent reallocated consequences of the oil shocks (Davis and Haltiwanger, 2001).

Economic policy uncertainty quantifies the level of risk (systematic) associated with the unpredictability of frameworks of regulatory and policies of government for the future, it is a key factor in determining economic uncertainty levels (Al-Thaqeb et al., 2022). EPU includes unforeseen changes in the economic system, which could have an impact on government regulatory, fiscal, political, and monetary policies (Al-Thaqeb et al., 2022). EPU impacts stock market volatility, stock return, and economic growth among others (Balcilar et al., 2020). EPU directly increases the systematic risk due to the uncertainty in the market. In today's interconnected world, there is an increase in the uncertainty related to the economic decisions and has a huge impact on the economies worldwide. Economic policy uncertainty also influences consumer spending and has a spillover effect on other countries (Al-Thaqeb et al., 2022).

Crude oil is a naturally produced liquid petroleum product that has been produced by the composition of organic material such as animals or plants layered by sand or even rocks under specific pressure and head, as well as hydrocarbon deposits. Crude oil is a form of raw material which is further refined to create commercial products such as gasoline and jet fuel. It is considered one of the most instrumental commodities as it is the main source of nonrenewable energy (CLARINE, 2011). Herrera et al. (2015) empirically determined there is an asymmetric (positive/negative) association amongst the OPS and economic activity. Countries that import oil, face recession when there is a soar in oil prices, and the after-shock response of economic activity is symmetric (Herrera et al., 2015).

Oil shocks result from the disruption in the supply distribution of oil as seen previously through political activities such as the Iranian revolution , Arab oil embargo, the Gulf conflict, and most recently Russia and Ukraine war. The imports also create oil supply disturbance, creating uncertainty regarding the supply of oil henceforth creating price volatility. In some cases, the geopolitical risk can create uncertainty levels which may adversely affect the oil supply. There can be a negative oil price shock. An example is the oil demand crash due to the pandemic declining the price by 30% (CNBC, 2020). A positive oil shock can be experienced due to military conflict or changes in the quotation of production (Finlay et al., 2022).The most recent oil price shock occurred when Russia attacked Ukraine. The oil price increased from $76 to 110$ per barrel during March. The variables of oil shocks and EPU have a long-term relationship (Lardic and Mignon, 2008).

Similarly, Chen and Bellavitis (2020) empirically analyzed the impact of EPU to OPS through VAR and discrete wavelet transform model. The findings depicted that the OPS had a statistically significant positive impact on EPU on the original level, but over varying timeframes, the effects are also time-varying. The medium-term impact of OPS on EPU is negative (Chen and Bellavitis, 2020). The positive/negative relationship signifies that the relationship among both variables does not have the same magnitude or impact. Moreover, both have a prominent influence on stock market. For example, in the United States, there is a negative influence on stock returns whenever there is a sudden change or increase in economic policy uncertainty because investors become concerned about future events such as the future supply of oil (Ewing et al., 2018).

Corden and Neary (1982) used the Dutc-disease-theory to explain that an upsurge in oil prices does not fully benefit the developing oil-exporting countries due to the change in the economic sector, which favors the oil-blooming against the trading sector. Hence, there is a higher negative asymmetric effect of the decrease in oil prices on the global economy as compared to vice versa, where the oil prices increase with a similar tendency (Corden and Neary, 1982).

Oil prices are the most volatile among many other commodities with dynamic price changes

and traded in global markets. The link between EPU and OPS is very evident. The study by Barrero et al. (2017)analyzed that the oil prices mainly drive the changes in EPU, impacting the uncertainty in the long run. Using a simulation model, the study concluded that the changes in EPU could decrease the country's overall growth (Barrero et al., 2017).

Zhou and Xiao (2018) investigated the asymmetric impact of the oil price on the stock market under varying conditions of the market using the crude oil volatility index in quantile regression. The research uses both positive-negative OPS and determines that oil price changes have an adverse impact on the return of the stocks as the reforms of 27 March 2013 reduced the influence of the positive shocks (Zhou and Xiao, 2018). Moreover, Ilyas et al. (2021)also investigated the impact of EPU and oil price uncertainty (OPU) on the level of investment made to the corporations. Their study applied the GLM regression based on robust standard error. According to the results, both EPU and OPS have a adverse influence on corporate investment. It also found that there is an adverse effect of EPU and OPU is more noticeable in countries that produce oil than those that consume it (Ilyas et al., 2021).

To determine the impacts of oil prices and EPU in China's, Zhou and Xiao (2018) used a time- varying-parametric-ector-autoregressive-model with unsystematic variation. The result shows positive impact of OPS is in the short term and diverse in the long term on the nonferrous metals industry. OPS have a positive effect on EPU in the short term. This short-term positive effect highlights the asymmetric relationship between EPU and oil prices (Zhou and Xiao, 2018). Similarly, Shahzad et al. (2020) studied the short and long-run asymmetries effect of oil shocks, stock market uncertainty, EPU, treasury rates, and investor sentiments in the U.S. using the NARDL approach. Whether positive or negative, the oil demand and supply shocks are more evident in the long run as compared to short run (Shahzad et al., 2020).

Recently, the study, state that on the asymmetric effects of OPS on EPU used a non-linear ARDL approach revealed that the crude oil price and EPU have a long-run equilibrium relationship. The bounds asymmetric test results found that the effect of positive and negative shocks of oil prices are asymmetric on EPU in the short run. On the contrary, in the long term, there is no asymmetric effect of positive and negative OPS on EPU. Additionally, a positive shock shows a substantial effect in the short-term when compared to a negative shock, while a negative shock has a greater impact in the long run in comparison to a positive shock.

The prior research showed the asymmetric effects of the OPS on EPU globally and not focusing on particular countries like Pakistan studying the cointegration relationship of the variables. Certain studies included a short sample period that is less than two months which is not sufficient to capture possible nonlinearities (Jeris and Nath, 2020). Moreover, there is a need to examine uncertainty caused by Pakistan's economic policy through the uncertainty indices such as the EPU in order to expand the scope of analysis (Degiannakis et al., 2018). Particularly, the research investigates the different effects of positive and negative OPS on Pakistan's EPU. Furthermore, to the best of our knowledge, none of the prior literature concentrated on the asymmetric impact of OPS that have recently arisen due to the geopolitical tension between Russia and Ukraine. Therefore, the study intends to fill the literature gap by analyzing the recent impact of the Ukraine-Russia war on the oil shocks and increasing supply shortage around the globe, as Russia is a significant producer and exporter of oil. Methodology

2.1 Data and Sample Selection

EPU is determined through information regarding the uncertainty of taxation regulations, government spending, and monetary plus regulatory policy. Furthermore, this is calculated

by estimating government purchasing, the dispute over future inflation, mentioning economic policies, and figures of the expired codes in Pakistani newspapers. We have use monthly data from August 2010 to October 2022. The data is collected by reviewing the frequency counts of the published articles from the top four English newspapers in Pakistan. Since the data is already available on the mentioned sources, there are to be no barriers in targeting the selected sample. Further, Fred's economic data detect Pakistan's crude oil price movements.

2.2 Variable Description

Table 2.1: Variable Description

Variable	Symbol	Source
Natural Log of EPU	LEPU	https://www.policyuncertainty.com/
Natural Log of crude oil prices	LOP	https://fred.stlouisfed.org/

2.3 Research Methodology

For the research, the EPU index is to be taken from the official website of policy uncertainty. The EPU index is calculated based on monthly data taken from the following newspapers: Business Recorder, Express Tribune, and Dawn calculating words indicating EPU. Furthermore, it standardizes each newspaper's scaled frequency counts of topics indicating uncertainty, such as policymakers, parliament, deficit, government, reserves, and more, to develop a standard deviation from August 2010 to October 2022. After this, a simple average will be taken for newspapers per month. Eventually, multiplicatively normalize the series to have a mean of 100 for respective periods. As for the variable of Volatility of the Stock Price Index for Pakistan, it is to be taken from the St. Louis Fed for a timeframe starting from August 2010 onwards. The oil prices (OP) are taken by downloading data from the Federal Reserve Bank of St Louis website.

The traditional ARDL technique (Pesaran et al.) did not consider the existence of the asymmetric relationship between the EPU and OP:

$$\Delta ln(EPU)_t = \tag{1}$$
$$\beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta ln(EPU)_{(t-i)} + \sum_{i=0}^{n2} \beta_{2i} lnOILP_{t-i} + \lambda_0 ln(EPU)_{t-1} + \lambda_0 ln(OILP)_{t-1} + \eta_t$$

Where β_1 and β_2 are the short-run multipliers and β_0 is a drift term (λ_0,λ_1,λ_2) are the long-run coefficients. Δln shows the first differences after taking each variable's logarithm.

This research uses the NARDL technique, it includes asymmetry in the long-run equilibrium relationship as well as asymmetry in the short-run dynamic coefficients. Furthermore, the asymmetry of variables, in the long run, is tested using Wald's test. The OILP vector is disentangled into partial sum (positive and negative) as follows:

$$OILP_t^- = \sum_{J=1}^{t} \Delta OILP_j^- = \sum_{j=1}^{t} min\left(\Delta OILP_j, 0\right) \tag{2}$$

$$OILP_t^+ = \sum_{J=1}^{t} \Delta OILP_j^+ = \sum_{j=1}^{t} max\left(\Delta OILP_j, 0\right) \tag{3}$$

The short and long-run asymmetry of the oil price on the EPU can be described as follows:

$$\Delta ln(EPU)_t = \beta_0 + \sum_{i=1}^{n1} \beta_{1i} \Delta EPU_{t-i} + \sum_{i=0}^{n2} \beta_{2i}^+ \Delta OILP_{t-i} + \sum_{i=0}^{n3} \beta_{3i}^- \Delta OILP_{t-i}^- + \lambda_0 ln(EPU)_{t-1} + \lambda_2^+ OILP_{t-1}^+ + \lambda_2^- OILP_{t-1}^- + \varepsilon_t \tag{4}$$

Wald test is used to test the next null hypothesis as an additional test for ARDL to find out long-run symmetry based on which the null hypothesis gets rejected, showing there is a symmetry in the long-run between OP and the EPU and the change of increase in x and change of increase in x will not have the same impact on change in y. Hence, to figure out the long-run impact of oil shocks on the EPU, the long-run symmetry hypothesis is accepted. The test is shown as follows:

$$LOILP^- = \left(\frac{-\lambda_2^-}{\lambda_0}\right) and LOILP^+ = \left(\frac{-\lambda_2^+}{\lambda_0}\right) \tag{5}$$

The short-term asymmetric effect is captured through hypotheses (null and alternative) of the symmetry, shown below:

$$H_0 : \Sigma_{(i=0)}^{q} (\lambda_{1i}^+) \neq \Sigma_{(i=0)}^{q} (\lambda_{1i}^-) \tag{6}$$

$$H_1 : \Sigma_{(i=0)}^{q} (\lambda_{1i}^+) \neq \Sigma_{(i=0)}^{q} (\lambda_{1i}^-) \tag{7}$$

The dynamic multipliers are used to analyze the asymmetric effects of the EPU on oil price changes as follows:

$$m_h^- = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\partial OILP_t^-} \quad m_h^+ = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\partial OILP_t^+} \tag{8}$$

Where, h $\rightarrow \infty$,

$$h \rightarrow \infty,\ m_h^- \rightarrow a_1^-,\ \ m_h^+ \rightarrow a_1^+, h = 0, 1, 2, 3, ...$$

$$for\, OLIP^- and\, OLIP^+,\ OLIP_h^- \rightarrow \beta_{1,}\ OLIP_h^+ \rightarrow \beta_{1,}$$

a_1^- and a_1^+ , shows the long-run coefficients that represent the asymmetric oil price effects on EPU.

Furthermore, reliability related to the outcomes and the model is checked through different stability tests, such as the normality being tested through Jarque-Bera, and autoregressive conditional heteroscedasticity is ensured through ARCH. Secondly, two diagnostic tests will be used, CUSUM and CUSUMQ tests, which ensure no false frequency in the model.

3 Empirical Results

3.1 Unit Root Tests

The main reason behind performing the following test is to confirm whether the variable is I (1) or higher because the NARDL model only allows a mix of level and first difference regressors. We apply ADF (Augmented-Dickey-Fuller) and PPT (Phillips-Perron-test-statistics) to analyze the variable's stationarity. Table 1 shows that EPU is integrated at I (0), indicating that EPU is stationary at level. Likewise, for the variable oil price, the Unit root test p-value is greater than 0.05 at a level for both ADF and PPT outputs. However, after applying the 1st difference, the OP becomes stationary. Therefore, the LOP is shown in the order of I(1). Therefore, the NARDL application can be continued in the analysis.

Table 3.1: Unit Root Test

Variables	Tests	Statistics	Prob	Conclusion
LEPU	Augmented Dickey-Fuller	-3.337	0.015	I(0)
	Phillips-Perron test statistic	-5.847	0.000	I(0)
LOP	ADF	-1.964	0.3023	I(0)
	ADF	-9.365	0.000	I(1)
	PPT	-1.983	0.2939	I(0)
	PPT	-8.853	0.000	I(1)

3.2 Asymmetric ARDL Model (Short and Long-Run)

Table 2 shows the estimated results of the analysis done for the short-run asymmetric ARDL model, the second part of Table 2 shows the long-run asymmetric ARDL model, and the third part of Table 2 provides the estimated findings of the cointegration existing between the OP and the EPU as provided by the bound test. It also shows the Long Run Form and Bounds Test results, which are performed to identify asymmetric cointegration. The results showed no cointegration existing; hence, the null hypothesis is rejected. The acceptance of alternative hypotheses confirms that the variables oil price (OP) and the EPU both have a cointegration relationship, as results of the test show that the negative shocks in oil prices have no impact on the EPU in the short run. On the other hand, the positive shocks in oil prices have a statistically significant impact on the EPU. Table 2 shows the analysis done for the long run, as it elaborates that both shocks in oil prices (positive and negative) have a statistically significant positive effect on EPU. Secondly, checking the system's stability is also ensured through the speed of adjustment, which is achieved successfully. Furthermore, the F-Bounds Test is the final part of the output, concluding that the series are cointegrated as the F-statistics value is 7.43, which eventually leads to the rejection of the null hypothesis due to the level of relationship existing between the variables. The following study has important results that will be helpful for policy-minded researchers as well as for the policymakers to focus on implementing the right macroeconomic policies in the short and long impact. Still, especially for the current period, as the impact of the negative

shock EPU negatively in the short-term hence they should design such policies which will result in controlling EPU as Pakistan relies on importing oil for numerous economic activities.

Table 3.2: Short and long-run asymmetric ARDL model

Variable	**Short run coefficient**	**T-Stat**	**P.value**
C	1.945	5.304	0.000
LEPU(-1)	-0.479	-5.416	0.000
LOP_POS	0.341	3.283	0.001
LOP_NEG(-1)	0.254	2.769	0.006
D(LEPU(-1))	-0.241	-2.985	0.003
D(LOP_NEG)	-0.427	-1.189	0.237
D(LOP_NEG(-1))	-0.613	-1.570	0.119
CointEq(-1)	-0.479	-5.514	0.000
R-squared	0.364	Adj. R^2	0.350
Variable	**Long run coefficient**	**t-Statistic**	**Prob.**
LOP_POS	0.712	3.850	0.000
LOP_NEG	0.529	3.069	0.003
F-Bounds Test Null Hypothesis: No levels of relationship			
Test Statistic	**Value**	**Sign.**	**I(0)**	**I(1)**
F-statistic	7.43	10	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

3.3 Wald Long-Run Asymmetry Test

Table 3 elaborates on Wald's results from applying the long-run asymmetry test. The null hypothesis of the following test states that the coefficient values involved are simultaneously zero. F-statistic and Chi-square test values show evidence of asymmetry in the long run for LOP, as shown in the Table by the value of 15.091 at 0.000 probability. Hence there is a non-linear relationship existing between the OP and the EPU. Henceforth, the null hypothesis is rejected as the coefficient value is not equal to zero.

3.4 Diagnostics Tests

The diagnostics test results are given in the following Table. It shows that residuals do not have serial correlation and heteroscedasticity, and there is a normal distribution between the

Table 3.3: Wald Test: Asymmetry result

Test Statistic	Value	df	P.value
T-statistic	3.885	138	0.000
F-statistic	15.091	(1, 138)	0.000
Chi2	15.091	1	0.000

regressors. The findings of both applied tests show no heteroscedasticity problem or autocorrelation. The test by Breusch-Pagan has a null hypothesis which states that homoscedasticity is present in the results as the residuals are distributed with equal variance. The test results show that F-statics have a p-value of 0.8948, above 5%, as shown in Table 4. Therefore, it confirms that the null hypothesis of the heteroscedasticity test cannot be rejected, and the residuals are not unequally distributed. Furthermore, the JB Test to check the normality also ensures that there is goodness-of-fit of data as the value of F-statistic is a positive value, and it is greater than zero. All the applied tests ensure that NARDL estimation is valid and reliable.

Table 3.4: Diagnostics Tests

Tests	F-statistic	P.vlaue
Breusch-Godfrey Serial Correlation LM Test	0.804	0.449
Heteroscedasticity Test: Glejser	0.533	0.782
Heteroscedasticity Test: ARCH	0.059	0.807
JB Test for normality	4.126	0.127
Heteroscedasticity Test: Breusch-Pagan-Godfrey	0.373	0.894
Heteroscedasticity Test: Harvey	0.619	0.714
CUSUM	Unstable	
CUSUMSQ	Stable	

3.5 Dynamic Non-Linear Multiplier Test

The dynamic multipliers graph, as shown in Figure 1, shows the dependent variable's pattern of adjustments following a POS or NEG unitary shock that has occurred in the oil prices. Figure 1 presents the result of changes in oil prices by 15 quadrants. The Multiplier graph provides related key information related to the variables. The black line represents the EPU adjustment over the horizon related to the increase in positive shock in LOP. In contrast, the continuous dashed black line shows the adjustments of the dependent variable EPU over the horizons when there is a negative shock in LOP. In addition, the asymmetric plot is shown by the middle red dashed line, and it represents the dynamic multiplier difference of both changes (positive and negative) in the regressors, which are more prominent in the short run as compared to the long run since the plots are moving in a more linear order in the long run. The

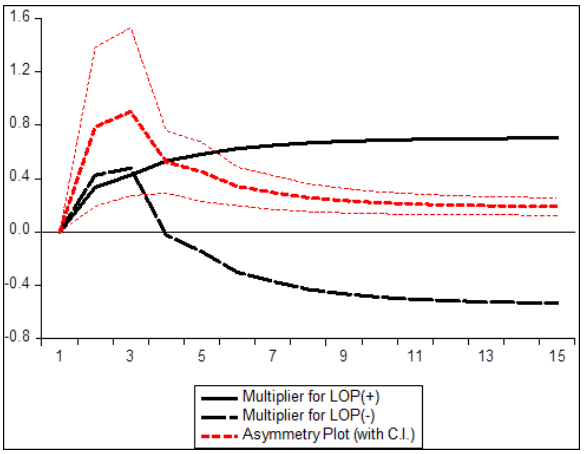

Figure 1: Ward multiplier graph

asymmetry line lies above the confidence intervals and moves above the 0. The asymmetric plots represent the difference, which clearly indicates that the shocks were more in the short run. The bold dashed line in red indicates that the both oil shocks have a difference of 1% for each. The black line shows that the EPU response to the positive shocks is positive, whereas it is negative for the negative shocks. However, it overlaps at points (0.4, 3). In general, the findings conclude that the magnitude of the increase is larger than the magnitude of the decrease in positive shock; the difference is a clear objective of the asymmetry. Investors and policymakers can use the test results to understand that short and long-run changes have different impacts on the market.

3.6 NARDL CUSUM and CUSUMQ Graphs

In addition, the CUSUM, which is a control chart, shows that the coefficients in the model are unstable as the resulting CUSUM does not lie between the 5% significance level. There are shifts in the process mean as shown in Figure 2a, but the CUSUM square graph Figure 2b confirms the stability as the CUSUM of Squares lies between the 5% significance level.

4 Discussion

The findings of this study are supported by citepchen2020; aimer2022. Herrera et al. (2015) conducted a study on 18 OECD countries. They found that the association among oil shocks and economic activity is considered to be asymmetric, which eventually has an impact on the EPU due to the after-shock effect of change in variables. Our study found a similar asymmetric impact of variations in oil prices on causing changes in the EPU. According to Chen et al. (2020), small and medium-term effects of the OPS on EPU are considered to be negative, while overall, the effect varies due to the varying time scales over which the data is collected, and the OPS influence the EPU positively at the original level.

Similarly, a past study states evidence that the changes in EPU can be effected due to both

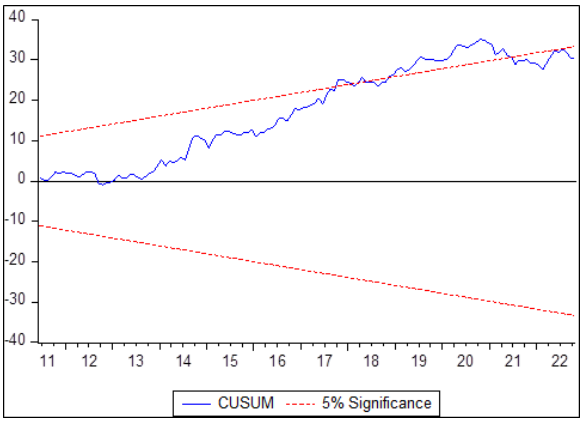

Figure 2: NARDL CUSUM graphs

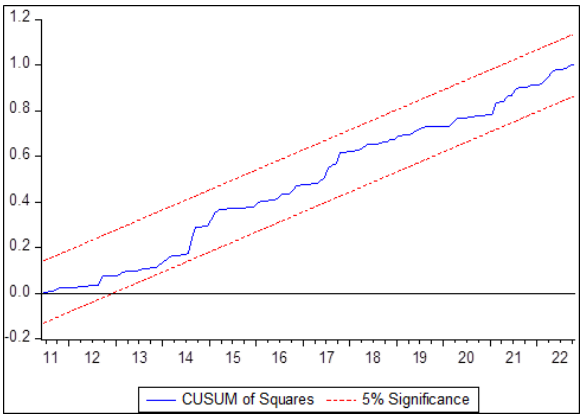

Figure 3: NARDL CUSUMQ graphs

positive/negative variations in oil prices; hence it leads to negative effects on the EPU in the short-run which eventually lead to grabbing the attention of the government and policymakers. Our study also found similar results as focusing on the short-term scenario, the negative OPS have negative effect on EPU. Moreover, by analysing the short-term negative impact, policymakers and the government can focus more on implementing the right policies, such as introducing new policy packages or storing oil resources when there is a boom in the market which can be used at the time of need due to sudden change.

The empirical investigation was conducted to check the relevance and association between the oil shocks and EPU while focusing on developing and emerging countries. His study found that the countries such as India and China have a significant response to the oil shocks that happen in overall global markets (Anees-ur Rehman et al., 2018). Similarly, our study also found a clear association between both variables in the context of Pakistan, which also imports oil from other countries to fulfill its needs hence the changes at the global level have a substantial impact on the Pakistani economy and induces changes in the policies when any such change occurs.

Anees-ur Rehman et al. (2018) analyze the association of different economic policies with the changes in oil prices while focusing on whether the stability in economic policies is significant for oil shocks. The analysis shows that the causal relationship between the variables OILP and EPU can be studied by taking long data to understand the short and long-term variations in the EPU, which resulted in finding that the oil prices have a much closer link with EPU in the short run as compared to the fiscal and trade EPU These results are similar to the results of our study that the changes whether they are positive or negative in oil-prices are more prominent in the short run.

Lastly, the recent study by Afza and Nazir (2014) observed the asymmetric effects of OPS on EPU using a similar NARDL model and found that in the long run, the variables have more of a linear relationship and fewer changes as compared to the short-run changes in OILP. Our study also found a similar result as seen in the Dynamic non-linear multiplier test, that the plots of changes in oil shocks move in a more linear order in the long run while there are sudden dynamic changes in the short run. However, our study also found that the magnitude of the increase due to the positive shocks is larger as compared to the magnitude of the decrease in the positive shocks, which further proves the asymmetric relationship existing between the oil shocks and economic policy uncertainty. Hence, our study supports the findings of other previous research. Furthermore, the study's findings can be used by investors and policymakers to understand the changes happening in both the long and short run and how these changes can impact the market so they can apply appropriate decision-making that is valuable for the economy. Future researchers working on a similar topic can also take guidance from our study to contribute more knowledge to the existing literature.

5 Conclusion

The research aimed to examine the asymmetric impact of OPS on EPU for 2015 to 2022 using NARDL model. The bounds test results illustrate that there is a long-run equilibrium relationship between OPS and EPU in the context of Pakistan. In the short run, there is a statistically insignificant effect of negative and positive OPS on the EPU. However, in the long-run positive OPS have a statistically significant impact on EPU. In the long run, the negative OPS have a statistically insignificant effect on EPU. Through dynamic non-linear multiplier tests, it was determined that positive and negative regression changes were more prominent in the short term compared to the long run. Additionally, the ECMt-1 coefficient is negative and statistically significant at level 1%, indicating the statistical significance between the variables in the long run. The speed of adjustments and return to equilibrium determined through error correction models elaborate the system is stable. A negative coefficient indicates that the value of EPU is higher than the equilibrium in the long run.

The magnitude of the increase in positive shock is larger than the magnitude of the decrease in negative shock, indicating there is an asymmetry in the short run. In the long run, there is also an asymmetry effect of negative and positive OPS on EPU. The scope of the research is to determine the relationship between EPU and OPS in Pakistan only. Another delimitation of the research is the timeframe with data only be from 2010 onwards mainly due to the development of EPU-2 taking place in 2010 which include the following newspapers: Business Recorder and Express Tribune. The research findings in the context of Pakistan can help both the policymakers and the investors, who will have a better indication of the impacts of oil-price shocks on the EPU both in the short and long run and going forwards, will make informed decisions. Future

research can include variables that measure volatility, such as the CBOE Volatility Index, which represents a forward view of investors' expectations.

References

Afza, T. and Nazir, M. S. (2014). Audit quality and firm value: A case of pakistan. *Research Journal of Applied Sciences, Engineering and Technology*, 7(9):1803–1810.

Al-Thaqeb, S. A., Algharabali, B. G., and Alabdulghafour, K. T. (2022). The pandemic and economic policy uncertainty. *International Journal of Finance & Economics*, 27(3):2784–2794.

Anees-ur Rehman, M., Wong, H. Y., Sultan, P., and Merrilees, B. (2018). How brand-oriented strategy affects the financial performance of b2b smes. *Journal of Business & Industrial Marketing*.

Balcilar, M., Gupta, R., Lee, C.-C., and Olasehinde-Williams, G. (2020). Insurance and economic policy uncertainty. *Research in International Business and Finance*, 54:101253.

Bank, W. (2017). *Global economic prospects, June 2017: a fragile recovery*. The World Bank.

Barrero, J. M., Bloom, N., and Wright, I. (2017). Short and long run uncertainty. Technical report, National Bureau of Economic Research.

Chen, Y. and Bellavitis, C. (2020). Blockchain disruption and decentralized finance: The rise of decentralized business models. *Journal of Business Venturing Insights*, 13:e00151.

CLARINE, F. J. F. (2011). How macro-liquidity impacts microliquidity in the us treasury bond market.

Corden, W. M. and Neary, J. P. (1982). Booming sector and de-industrialisation in a small open economy. *The economic journal*, 92(368):825–848.

Davis, S. J. and Haltiwanger, J. (2001). Sectoral job creation and destruction responses to oil price changes. *Journal of monetary economics*, 48(3):465–512.

Degiannakis, S., Filis, G., and Arora, V. (2018). Oil prices and stock markets: A review of the theory and empirical evidence. *The Energy Journal*, 39(5).

Ewing, B. T., Kang, W., and Ratti, R. A. (2018). The dynamic effects of oil supply shocks on the us stock market returns of upstream oil and gas companies. *Energy Economics*, 72:505–516.

Finlay, R., Titkov, D., and Xiang, M. (2022). The yield and market function effects of the reserve bank of australia's bond purchases.

Herrera, A. M., Lagalo, L. G., and Wada, T. (2015). Asymmetries in the response of economic activity to oil price increases and decreases? *Journal of International Money and Finance*, 50:108–133.

Ilyas, M., Mian, R. U., and Safdar, N. (2021). Institutional investors and the value of excess cash holdings: empirical evidence from pakistan. *Managerial Finance*, 48(1):158–179.

Jeris, S. S. and Nath, R. D. (2020). Covid-19, oil price and uk economic policy uncertainty: evidence from the ardl approach. *Quantitative Finance and Economics*, 4(3):503–514.

Lardic, S. and Mignon, V. (2008). Oil prices and economic activity: An asymmetric cointegration approach. *Energy Economics*, 30(3):847–855.

Shahzad, K., Ali, T., Kohtamäki, M., and Takala, J. (2020). Enabling roles of relationship governance mechanisms in the choice of inter-firm conflict resolution strategies. *Journal of Business & Industrial Marketing*, 35(6):957–969.

Wen, S., Lin, B., and Zhou, Y. (2021). Does financial structure promote energy conservation and emission reduction? evidence from china. *International Review of Economics & Finance*, 76:755–766.

Zhou, J. and Xiao, T. (2018). Analyzing determinants of household financial decision-making: Household stock investment in china. *Emerging Markets Finance and Trade*, 54(15):3385–3400.