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Asymmetric Effect of Oil Prices on Inflation in Pakistan using a NARDL Econometric Approach

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Abstract: *This study investigates the impact of oil price fluctuations on inflation in Pakistan, focusing specifically on asymmetric effects. Employing the Nonlinear Autoregressive Distributed Lag (NARDL) model, it examines how oil price increases and decreases influence inflation differently. Using secondary annual data from the Pakistan Bureau of Statistics and the State Bank of Pakistan, the study considers the Consumer Price Index (CPI) as the dependent variable, while independent variables include domestic oil prices (LOP), exchange rate (LEXH), interest rate (LINTR), and unemployment rate (LUNEMP). Results indicate that oil prices significantly affect inflation, with past oil prices exhibiting a persistent impact. The NARDL model highlights asymmetry, showing that oil price increases (LOP_POS) exert a stronger positive effect on inflation than decreases (LOP_NEG). Exchange rate fluctuations display mixed effects, with lagged depreciation negatively influencing inflation, while interest rates and unemployment rates do not demonstrate statistically significant long-run effects. Given the asymmetric effects, monetary authorities should implement differentiated strategies for oil price increases and decreases to manage inflation effectively. Additionally, exchange rate stability plays a crucial role in mitigating inflationary pressures.*

Keywords: Oil prices, Inflation, ARDL model Asymmetric effects, NARDL model, Exchange rate, Interest rate, Unemployment, Pakistan economy, monetary policy.

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1. Introduction

Inflation, a sustained increase in the general price level of goods and services in an economy over time, is a critical macroeconomic concern with far-reaching consequences. Understanding the factors that drive inflation is essential for effective policymaking. Extensive research has identified various determinants, including domestic oil prices (Greenidge and DaCosta, 2009; Eftekhari-Mahabadi and Kiaee, 2015), monetary policy adjustments (Dhakal et al., 1994; Baldin and Poplawski-Ribeiro, 2011), domestic supply shocks (Boschi and Girardi, 2007; Lagoa, 2017), and demand shocks (Lim and Sek, 2015; Deniz et al., 2016). However, a significant gap exists in the literature regarding the asymmetric impact of these factors, particularly oil prices, on inflation. This study focuses on this crucial aspect within the context of Pakistan.

While existing literature acknowledges the influence of oil prices on inflation, it often assumes a symmetric relationship, suggesting that the effect of an oil price increase is equal in magnitude and opposite in direction to the effect of an equivalent oil price decrease. This assumption may not hold true in reality. Recent research has emphasized the importance of considering asymmetries in the transmission of various shocks to inflation. For instance, studies have investigated the asymmetric transmission of economic policy uncertainty (EPU) shocks (Istiak and Serletis, 2018; Wen et al., 2021; Long et al., 2022). Furthermore, the impact of oil price uncertainty on economic activity has also been documented (Elder and Serletis, 2010; Jo, 2014).

This growing body of evidence suggests that neglecting asymmetries can lead to misspecified models and inaccurate policy recommendations. A key gap in the literature is the lack of comprehensive studies that examine the asymmetric effects of *both* oil price levels *and* oil price uncertainty on inflation, particularly within developing economies like Pakistan. While some studies have touched upon aspects of uncertainty related to inflation and output growth *(Grier and Perry, 1998; Neanidis and Savva, 2013),* a thorough investigation of the distinct impacts of positive and negative oil price changes on inflation remains limited. This study aims to address this gap. Oil prices have historically played a crucial role in Pakistan's economic landscape. As a net oil importer, Pakistan is particularly vulnerable to fluctuations in global oil markets. The relationship between oil prices and inflation is of paramount importance due to its direct impact on the cost of living, production costs, and overall economic stability. The recent volatility observed in global oil markets has further underscored the need for a deeper understanding of this relationship, especially the potential for asymmetric effects on inflation.

Despite the extensive literature on the oil price-inflation nexus, there is a notable gap in research specifically addressing the asymmetric effects of oil price fluctuations within the Pakistani economy. Traditional models often assume a linear and symmetric relationship, which fails to capture the potential differential impacts of oil price increases and decreases. This oversight can result in inaccurate assessments of inflationary pressures and ineffective policy responses. These contextual complexities advocate for the inclusion of asymmetries and external shocks in inflation modeling, highlighting the significance of the NARDL framework in the Pakistani context, where oil price shocks considerably influence inflation trajectories.

This study aims to address this significant gap by using an asymmetric approach to provide a more accurate representation of the oil price-inflation dynamics in Pakistan. The primary objectives of this study are:

- Analyze the impact of oil price fluctuations on inflation in Pakistan.
- Utilize the Nonlinear Autoregressive Distributed Lag (NARDL) model to examine this asymmetric relationship.
- Propose policy recommendations based on empirical findings to help manage inflationary pressures.

This study seeks to answer the following research questions:

- What are the differential impacts of oil price increases and decreases on inflation in Pakistan?
- Does the NARDL approach offer superior insights into the asymmetric effects of oil prices on inflation compared to traditional symmetric models?
- What are the policy implications of the findings for managing inflation in Pakistan?

This study is significant because it provides a more nuanced understanding of the complex relationship between oil prices and inflation in Pakistan by explicitly considering asymmetry. By employing the NARDL methodology, the research aims to offer more accurate and robust empirical evidence that can inform the design and implementation of more effective monetary and fiscal policies for managing inflation. Furthermore, this study contributes to the broader academic literature by addressing a critical gap in understanding the dynamics between oil prices and inflation, particularly in the context of developing economies. Although numerous studies have investigated the relationship between oil prices and inflation, most adopt linear and symmetric econometric frameworks. These traditional models assume that the impact of oil price increases and decreases on inflation is equal in magnitude but opposite in direction. However, this assumption does not adequately reflect the inflationary dynamics in Pakistan, where factors such as import dependency, energy subsidies, supply chain inefficiencies, and policy rigidities can cause inflation to respond asymmetrically to oil price changes.

Recent international research has started to use nonlinear approaches, especially the Nonlinear Autoregressive Distributed Lag (NARDL) model, to evaluate such asymmetric relationships. However, Pakistan-specific applications of the NARDL model are still few, and existing studies often suffer from limited time spans, narrow variable selection, or an exclusive focus on either headline or sectoral inflation.

Moreover, the interlinkages between oil price shocks and key macroeconomic control variables—such as exchange rate fluctuations, interest rates, and unemployment—have largely been overlooked in the context of Pakistan. This limits the understanding of the broader macroeconomic transmission mechanism through which oil price asymmetries impact inflation.

This study fills these gaps by:

- Applying the NARDL approach to explicitly capture short-run and long-run asymmetries in the relationship between oil prices and inflation.
- Using a comprehensive set of macroeconomic control variables to enhance the robustness of the model.

- Providing Pakistan-specific empirical evidence to inform inflation management policies amid oil price volatility.

This research provides novel insights into the literature on asymmetric inflationary responses to oil shocks in developing oil-importing economies, particularly within the context of Pakistan's unique structural and macroeconomic landscape.

The scope of this study includes analyzing the asymmetric effects of oil prices on inflation in Pakistan over a specific period (to be specified). The NARDL approach will serve as the primary analytical tool. However, the study acknowledges certain limitations, such as potential data limitations (availability and reliability), the possible influence of external shocks not explicitly modeled, and the inherent limitations of the econometric methodology used. Future research directions may involve incorporating additional macroeconomic variables or exploring alternative econometric techniques.

2. Literature Review

Recent studies have increasingly focused on asymmetric relationships in macroeconomic variables, particularly those utilizing the Nonlinear Autoregressive Distributed Lag (NARDL) framework. Asad et al. (2021) employed the NARDL model with dynamic multipliers to investigate asymmetries in the gold-oil-exchange rate volatility nexus and its impact on the Bombay Stock Exchange during the 2008 global financial contagion. Their findings emphasized the importance of asymmetries in commodity markets and validated the suitability of the NARDL approach in capturing such dynamics beyond symmetry. This methodological advancement provides crucial insight for examining the asymmetric pass-through of oil prices to inflation in Pakistan, as inflation may respond differently to oil price increases compared to decreases due to structural and market rigidities. Furthermore, while Asad et al. (2025a, 2025b) concentrated on sustainability, innovation, and entrepreneurial behavior, their recognition of dynamic external environments—such as technological turbulence and market uncertainty—reflects the volatility and non-linear transmission mechanisms present in oil price movements. These contextual complexities reinforce the necessity of including asymmetries and external shocks in inflation modeling, supporting the application of the NARDL framework in the Pakistani context where oil price shocks significantly influence inflation trajectories.

Khan et al. (2024) applied the NARDL model to assess the asymmetric influence of global oil price shocks on Pakistan's sectoral inflation. They found stronger inflationary responses to oil price hikes compared to declines, particularly in the transport and manufacturing sectors. Ahmed & Ullah (2024) examined the asymmetric transmission of oil price shocks to headline and core inflation in South Asia. Their findings confirmed that oil price increases have a more significant and prolonged inflationary effect than decreases, validating the use of NARDL models for inflation targeting in oil-importing economies.

Malik (2024) investigated the impact of oil price changes on inflation in Pakistan using the linear Phillips Curve framework and the ARDL model, concluding that oil prices significantly influence domestic inflation. While the study confirmed a long-run relationship, it treated oil price changes as symmetric, assuming that increases and decreases have proportionate effects on inflation. However, this assumption may oversimplify the true nature of oil price transmission, especially in developing economies like Pakistan, where cost-push inflation is often more responsive to oil price hikes than declines. The limitations of symmetric models, as highlighted in Malik's work, emphasize the necessity of employing nonlinear approaches like the NARDL model, which can better capture the asymmetric dynamics of oil price shocks on inflation. Incorporating such asymmetries allows for a more nuanced understanding of how inflation responds differently to positive and negative oil price movements, offering deeper policy implications for inflation targeting and energy pricing strategies in Pakistan.

Ali and Qasim (2022) utilized the ARDL model to examine the effect of petroleum prices and exchange rates on inflation in Pakistan, revealing a positive long-term relationship between petroleum prices and inflation. Their findings emphasize the significance of energy costs in driving domestic price levels, consistent with cost-push inflation theory. However, the reliance on a symmetric ARDL framework constrains their analysis by assuming that inflation responds equally to both increases and decreases in petroleum prices. In reality, inflationary pressures in Pakistan may be more sensitive to oil price increases than to decreases, due to structural inefficiencies, market rigidities, and fiscal policies. This underscores the necessity for more advanced modeling techniques, such as the NARDL approach, which accounts for asymmetric adjustments and provides a deeper understanding of how oil price shocks—both positive and negative—affect inflation dynamics in the country.

Shahzad et al. (2022) examined the linear impact of oil prices, exchange rates, and interest rates on the stock market of Pakistan using the ARDL model, highlighting significant relationships among these macroeconomic variables. Their findings confirmed that oil prices exert a measurable influence on financial markets, but the use of a symmetric ARDL model limited the analysis to average effects, overlooking potential nonlinearities. This limitation emphasizes the increasing need to explore asymmetric responses, particularly in macroeconomic variables like inflation, where price shocks may have varying intensities and directions of impact. While their research provides foundational insights into the oil-price connection with key economic indicators, it also stresses the importance of adopting nonlinear models such as NARDL to capture the complex, real-world dynamics of oil price fluctuations, especially in energy-importing economies like Pakistan, where positive and negative oil shocks can lead to differing inflationary responses.

Wang & Zhang (2023) studied BRICS economies and found that positive oil price shocks had stronger spillover effects on inflation than negative ones. The study utilized nonlinear quantile autoregression, supporting the need for asymmetry in inflation modeling. Ibrahim & Rehman (2023) investigated how oil price volatility affects inflation expectations in developing countries. Their panel study revealed significant asymmetries and suggested that inflation expectations adjust more rapidly in response to oil price increases. Hussain et al. (2023) employed a structural NARDL approach to assess the asymmetric responses of inflation to external shocks in Pakistan. The study confirmed that oil prices, exchange rates, and food prices all exhibit asymmetric effects on inflation dynamics.

Li and Guo (2022) found limited evidence of asymmetric effects of oil price shocks on inflation within the context of BRICS nations, specifically highlighting the unique situation in Pakistan compared to other emerging economies. Husaini and Lean (2021) showed that oil price shocks have a strong, positive impact on inflation in Southeast Asian economies, which could also be a relevant observation for Pakistan given its economic structure and regional similarities. Charfeddine and Barkat (2020) explored the asymmetric impact of oil price shocks on Qatar's GDP and economic diversification, finding that positive shocks to oil prices and revenues had a more significant long-term impact than negative shocks. Ali (2020**)** this study affirmed that oil price shocks serve as key drivers of inflation, particularly in both developed and emerging countries, establishing oil price changes as crucial factors in inflation dynamics.

Deluna et al. (2021) their findings underscored the significant role of oil price shocks in driving inflation trends across multiple countries, both in the short term and long term, contributing to a greater understanding of inflationary pressures in relation to oil prices.

Nasir et al. (2019) examined the impact of oil price shocks on macroeconomic variables in the Gulf Cooperation Council (GCC) countries, noting significant heterogeneity in the responses of these economies, particularly regarding inflation and GDP growth, due to varying degrees of dependence on oil revenues. Omolade et al. (2019) found that significant drops in oil prices were associated with increases in inflation across eight African oil-producing countries, suggesting that the inflationary response was more structural than monetary. Zivkov et al. (2019) found that the transmission of oil price changes to inflation was relatively slow in Central and Eastern European countries, with a 100% increase in oil prices leading to a rise in inflation of 1-6 percentage points. In Algeria, Lacheheb & Sirag (2019) observed that oil price increases and decreases had notably different impacts on inflation, highlighting asymmetry in the relationship. Kriskkumar & Naseem (2019) used Augmented ARDL and NARDL models to study the effect of oil prices on economic growth in Malaysia.

Pal & Mitra (2019) confirmed short-term asymmetric spillover effects from oil price changes to U.S. inflation by employing advanced models, though long-term effects were less pronounced. Gong & Lin (2018), focusing on China, reported that oil supply and demand shocks influenced inflation differently, demonstrating the nuanced relationship in a major emerging market. Tiwari et al. (2019) indicated through their wavelet coherence analysis that oil price spillover effects on inflation had diminished significantly over time.

Choi et al. (2018) noted that a 10% increase in global oil prices generally results in an average boost of around 0.4 percentage points in domestic inflation, with the impact being more pronounced for positive oil price shocks than for negative ones. Bala and Chin (2018) explored the link between oil price fluctuations and inflation in Algeria, Angola, Libya, and Nigeria. Salisu et al. (2017) examined the non-linear association between oil prices and inflation in both oil-exporting and importing nations. Kelikume (2017) pointed out that rising oil prices significantly drove inflation higher in Nigeria, whereas falling oil prices had a comparatively minor effect. Gbatu et al. (2017) studied the consequences of oil price shocks in Liberia, discovering that, unlike in most developed countries, increasing oil prices positively influenced the economy by enhancing employment and capital intensity, while decreasing oil prices negatively affected GDP growth.

Anwar, Khan, and Khan (2017) utilized Granger causality tests to analyze the effects of petrol price changes on inflation in South Africa, revealing a significant positive relationship between oil prices and inflation in Pakistan from 2002 to 2011. Malik (2016) examined the long-term influences of oil price hikes on inflation in Pakistan from 1979 to 2014, while Al-Eitana and Al-Zeaud (2017) looked into how crude oil price volatility affects inflation in Jordan. Rangasamy (2017) also employed Granger causality tests to study the impact of petrol price changes on inflation in South Africa.

Jawad et al. (2017) discussed the implications of the global financial crises of 2008-09 and the European sovereign debt crises of 2010-12, which created investor uncertainty that impacted both financial and energy markets. This volatility likely contributed to changes in the relationship between oil prices and important determinant variables. Donayre & Wilmot (2016) explored the asymmetric effects of oil price shocks on oil-exporting countries.

Gokmenoglu, Bekun, and Taspinar (2016) emphasized that Nigeria's economy is predominantly reliant on the oil sector. As a result, variations in oil prices significantly influence tourism demand, as tourism is often perceived as a luxury. Nusair (2016) applied the nonlinear autoregressive distributed lag (NARDL) model to validate the asymmetric effects of oil price shocks. Aziz & Dahalan (2015) researched the impact of oil prices on the economic performance of Malaysia and other nations using a panel VAR model.

Pal and Mitra (2015) determined that the effects on oil products depend on the scale and direction of changes in oil prices. Shin (2014) discovered that the Non-Linear Autoregressive Distributed Lag (NARDL) method facilitates the simultaneous modeling of asymmetries and co-integration dynamics. Nugent and Switek (2013) observed significant asymmetries in the influence of oil prices on oil-exporting and oil-importing nations, revealing a negative correlation for importers and a positive one for exporters. Reboredo (2012) indicated that recent fluctuations in food prices were not directly due to substantial increases in oil costs, suggesting a more intricate relationship. Khan (2011) emphasized that understanding the link between oil prices and food prices is essential for grasping inflation dynamics in developing economies. Goel and Rohit (2015) investigated the connection between oil prices and exchange rates in India, finding that rising oil prices caused the Indian rupee to depreciate against the US dollar, subsequently elevating the country's nominal exchange rate.

Rafee and Hidhayathulla (2015) analyzed the relationship between international crude oil prices and inflation in India between 2011 and 2014, revealing no significant correlation between crude oil prices and CPI inflation, verified by the Granger Causality test. Mansor and Kanokwan (2014) studied how crude oil prices influence price indices in Thailand, concluding that increases in oil prices had a stronger effect on inflation in energy, transportation, communication, and non-food sectors. Tuhran et al. (2012) examined the exchange rates of thirteen emerging economies before and after the financial crisis, noting that post-crisis oil price hikes resulted in local currency depreciation against the US dollar. Shaari et al. (2012) evaluated the impact of oil price shocks on inflation in Malaysia, finding a long-term connection between oil prices and inflation, with only crude oil prices significantly affecting Malaysian inflation in the short term.

Atif et al. (2012) utilized multiple linear regressions to analyze the effect of high-speed diesel oil prices on food sector inflation in Pakistan from 2001 to 2010, concluding that increasing diesel prices had a considerable effect on food inflation in the nation. Arinze (2011) explored the link between petrol prices and inflation in Nigeria, revealing that increasing petrol prices resulted in higher inflation according to the consumer price index (CPI). Nazlioglu and Soytas (2011) examined the relationship between crude oil prices, exchange rates, and agricultural prices in Turkey, finding that crude oil price shocks did not significantly impact agricultural prices or exchange rates. Baffes and Dennis (2013) noted that fluctuations in oil prices directly affect food prices, which subsequently influence overall inflation and economic stability.

Jongwanich and Park (2011**)** found that the fluctuations in global oil and food prices have a minimal effect on inflation in Asian countries, indicating that domestic factors play a more significant role. Fatima and Bashir (2014**)** found that changes in oil prices significantly impact stock market fluctuations, highlighting the interconnectedness of oil prices and economic performance in countries like Pakistan. Ivanic et al. (2012) found that the surge in food prices during 2010-11 had notable short-term poverty implications, emphasizing the critical link between oil prices and economic conditions. Hamdi and Sbia (2013)The dynamic relationship between oil revenues and economic growth is crucial for oil-dependent economies, as fluctuations in oil prices can lead to significant economic challenges.Wang et al. (2014)Oil price shocks have a substantial effect on agricultural commodity prices, which can further influence inflation rates and economic stability."

Doğ rul and Soytas (2010) the asymmetric effects of oil prices on economic growth highlight the need for tailored policy responses to manage inflation. Kilian (2009) "Oil price shocks have significant effects on the macroeconomic performance of oil-importing countries, leading to increased inflation and reduced economic growth. Apergis and Miller (2009) the relationship between oil prices and inflation is complex, with varying effects across different sectors of the economy Malik (2010) Oil price shocks typically lead to a reduction in economic activity while simultaneously driving up inflation rates. The transmission of oil price changes influences various economic indicators, including wages, investment, and inflationary pressures.

Lescaroux and Mignon (2008) Oil prices impact economic activity and inflation through several channels. Higher crude oil prices increase the cost of petroleum products, escalating energy bills for consumers and production costs for businesses, thereby affecting wages, employment, and inflation. Cavallo (2008) . The extent to which oil price increases translate into core inflation depends on the incorporation of these costs into inflation expectations by price and wage setters. Prolonged oil price increases can lead to sustained inflation, which may subside when prices decline. Pesnani et al. (2008) Pakistan's inflation rates have been significantly influenced by rising global oil prices and increased food import costs. Subsidies on oil and food commodities have mitigated the impact to some extent.

3. Data and Methodology

This study employs the Nonlinear Autoregressive Distributed Lag (NARDL) approach using annual data from 1980-81 to 2023-24. The model incorporates the logarithmic values of the Consumer Price Index (LCPI), domestic oil prices (LOP), exchange rate (LEXH), interest rate (LINTR), and unemployment rate (LUNEMP). Data is obtained from the State Bank of Pakistan's Handbook of Statistics and the Pakistan Bureau of Statistics. The methodology includes unit root tests, the NARDL Bound Test to identify long-run relationships, and Pairwise Granger Causality Tests to examine causal linkages. Robustness checks are performed to validate the model's reliability.

This study is based on secondary annual time series data from 1980-81 to 2023-24. Data on key macroeconomic indicators, including the Consumer Price Index (CPI), domestic oil prices, exchange rates, interest rates, and unemployment rates, are sourced from the State Bank of Pakistan's Handbook of Statistics and the Pakistan Bureau of Statistics. This study considers the Consumer Price Index as the dependent variable, while domestic oil prices, exchange rates, interest rates, and unemployment rates serve as independent variables.

Table 1: Collection Sources

Variable	Sign	Frequency	Data Source
Dependent Variable			
Consumer Price Index	LCPI	Annual	Pakistan Bureau of Statistics
Independent Variables			
Domestic Oil Prices	LOP	Annual	Pakistan Bureau of Statistics
Exchange Rate	LEXH	Annual	State Bank of Pakistan
Interest Rate	LINTR	Annual	State Bank of Pakistan
Unemployment Rate	LUNEMP	Annual	Pakistan Bureau of Statistics

The descriptive statistics in Table 2 present an overview of the distribution and characteristics of the selected variables. The mean values reflect the average levels, with the exchange rate (LEXH) at 3.90, the interest rate (LINR) at 2.10, the unemployment rate (UNEP) at 0.87, inflation (LINF) at 2.06, and oil prices (LOP) at 3.49. The median values are close to their respective means, indicating a relatively balanced distribution. The maximum and minimum values highlight significant fluctuations, particularly in oil prices (1.22 to 5.94) and the exchange rate (2.29 to 5.64). Standard deviation values reveal the highest dispersion in oil prices (1.35) and the exchange rate (0.87). Skewness values demonstrate slight asymmetry, with interest rates being more negatively skewed (-1.11). Kurtosis results suggest that most variables are within a normal range, except for interest rates, which exhibit a peaked distribution (7.06). The Jarque-Bera test confirms normality for most variables, except for interest rates, which have a probability value of 0.000, indicating a deviation from normality. These descriptive statistics offer a foundational understanding of the data before performing further econometric analysis.

Table 2: Descriptive Statistics of Variables

	LEXH	LINR	UNEP	LINF	LOP
Mean	3.9036	2.1014	0.8650	2.0558	3.4897
Median	4.0684	2.1510	1.1280	2.1392	3.5823
Maximum	5.6450	3.0819	1.7833	3.3658	5.9451
Minimum	2.2935	0.5282	-0.3710	1.0497	1.2170
Std. Dev.	0.8763	0.4089	0.6023	0.5396	1.3579
Skewness	-0.0915	-1.1104	-0.6507	0.0404	-0.1807
Kurtosis	2.1467	7.0614	2.1525	2.5807	1.8678
Jarque-Bera	1.3962	39.2832	4.4221	0.33421	2.5895
Probability	0.4975	0.0000	0.1095	0.8461	0.2739

Source: Authors' calculations.

4. Stationarity Test

The Augmented Dickey-Fuller (ADF) test is applied to examine whether the data series has a unit root. The p-values from the ADF test indicate the stationarity of each variable. A variable is considered stationary if its p-value is below the 5% significance level ($p < 0.05$), which suggests the rejection of the null hypothesis of a unit root. According to Table 2, LINF ($p = 0.0208$) is stationary at level, meaning it does not require differencing. LEXH ($p = 0.9727$) and UNEP ($p = 0.5257$) have p-values greater than 0.05, indicating non-stationarity at level. However, after taking the first difference, UNEP becomes stationary with a p-value of 0.0000, confirming its integration at I(1). LINR ($p = 0.0301$) is slightly above the threshold but still within the range of stationarity at level. Since the variables exhibit mixed integration orders, with some being I(0) and others I(1), the ARDL model is the appropriate econometric approach for further analysis.

Table 3: Unit Root Test (ADF Test)

Variable	Level t-Statistic	Prob.*	First Difference tStatistic	Prob.*	Stationary
LEXH	0.2500	0.9727	-5.5344*	0	I(1)
LINF	-3.3130*	0.0208	-	-	I(0)
LINR	-3.1539*	0.0301	-	-	I(0)
UNEP	-1.4968	0.5257	-8.6593*	0	I(1)

Source: Authors' calculations.

Note: MacKinnon (1996) one-sided p-values.

ARDL and ECM Model

To investigate the long-run and short-run nexus, the ARDL bound test is applied as a prerequisite of the ARDL model to test the existence of a long-run relationship. According to Pesaran et al. (2001), the purpose of applying the ARDL bound test is to verify the degree of dependency between the independent variables and the dependent variable of the models. Additionally, to validate the results of the bound test, the ARDL short-run and ECM long-run models are employed on all three models.

In this study, diagnostic techniques, namely normality test, serial correlation LM test, residual diagnostics for heteroskedasticity, and stability diagnostics are utilized. The normality test is applied to verify that the model follows a normal distribution. The Breusch-Godfrey serial correlation LM test is used to check for the presence of autocorrelation in the model. To authenticate data stability, CUSUM and CUSUMSQ tests are applied.

ARDL Bound Test for Model 1

Referring to the results of Table 4, the F-statistic is significantly larger than the upper bound at all significance levels. Hence, it is determined that co-integration exists in Model 1. To further validate the findings of the ARDL bound test for Model 1, the ARDL short-run and ECM long-run models are employed.

Table 4: ARDL Bound Test

ARDL Bound Test (*F-stats)	Significance Level	Lower Bounds	Upper Bounds	Co-integration
	10%	2.306	3.353	
5.20	5%	2.734	3.920	Yes
	2.5%	3.657	4.790	
	1%	3.657	5.256	

H0: No levels relationship at 5% significance level
ARDL Short-Run and ECM Long-Run Model
Source: Authors' calculations.

Table 4 exhibits the results of the ARDL co-integration and long-run form.

Nonlinear ARDL (NARDL)

The NARDL equation is as:

Let $LCPI_t = \text{In}(CPI_t)$, $LOP_t = IN(OP_t)$, $LEXH_t = In(EXH_t)$, $LINTR_t = In(INTR_t)$ and

$LUNEMP_t = In(UNEMP_t)$

We decompose the oil price variable LOP_t into partial sums of **positive** and **negative** changes to model asymmetry:

$LOP_t = \Sigma_{j=1}^{t} \max(\Delta \text{LOPj}, 0)$, $\text{LOP}_t = \Sigma^{t j=1} \Delta LOP^{j} = \Sigma^{t j=1} \min(\Delta LOP^{j}, 0)$

The Nonlinear Autoregressive Distributed lag (NARDL) model is formally defined as:

$\Delta LCPI_t = \alpha o + \Sigma^{P}{}_{i}{}^{=1}\, \alpha_i \Delta LCPIt^{-1} + \quad \Sigma \quad \Sigma_i{}^{=1} \beta_i + \Delta LOP^{t-1} + \Sigma_i{}^{=\circ} \beta_i - \Delta LOP_t{-}^{1}$

$+ \quad \Sigma_i{}^{=\circ} \gamma_i \Delta LEXH^{t-} + \Sigma_i{}^{=\circ} \delta \Delta LINTR_t{-}^{1} + \Sigma_i{}^{=\circ} \phi \Delta LUNEMP^{t-1} + \theta^1 LCPI_t{-}^{1} + \theta^2 LOP_t{-}^{1} + \theta^3 \text{LOP}^{t-1} + \theta^4 \text{LEXH}^{t-1} + \theta^5 \text{LINTR}^{t-1} + \theta^6 \text{LUNEMP}^{t-1} + \varepsilon_1$

Variable:

- In (CPI_t):Log of consumer price index at time t
- In $OP + t), In\ (OP - t)$: Partial sums of positive and negative changes in oil prices
- (Decomposed via shin et al.(2014))
- InEXH_t): Log of exchange rate
- In $(intr_t)$: Log of interest rate
- In $(UNEMP_t)$:Log of unemployment rate
- Δ: first difference operator
- ε_t: Error term
- $\theta's$: Long run coefficient
- $\alpha, \beta+, \beta-, \gamma, \delta, \phi$:short run coefficients

Table 5: ARDL Co-integration short Run and Long Run Form (ARDL (3, 0)) ARDL Short-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Significance
D(LINF(-1))	0.5503	0.1502	3.6642	0.001	***
D(LINF(-2))	-0.0823	0.1646	-0.4998	0.6208	
D(LINF(-3))	0.2448	0.1600	1.5298	0.1365	
D(LINF(-4))	-0.3582	0.1311	-2.7322	0.0104	***
CointEq(-1)*	-0.2300	0.0400	-6.4100	0.0000	***

Long-Run Coefficients (ARDL Model)

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Significance
LEXH	-0.1192	0.3677	-0.3242	0.7480	
LINR	0.1872	0.1845	1.0148	0.3183	
LOP	1.8253	0.4664	3.9130	0.0005	***
LOP(-1)	-1.5901	0.3996	-3.9789	0.0004	***
UNEP	-0.1257	0.0944	-1.3306	0.1933	
Constant (C)	0.7334	0.7157	1.0248	0.3136	

Source: Authors' calculations.
Note: *** indicates significance at the 1% level.

The p-values from the ARDL short-run and long-run coefficients indicate the statistical significance of the variables. In the short run, D(LINF(-1)) (p = 0.001), D(LINF(-4)) (p = 0.0104), and CointEq(-1) (p = 0.0000) are significant at the 1% level. The ECM term validates the result of the bound test, as the ECM value is negative and statistically significant, confirming the long-run relationship in this model. In the long run, LOP (p = 0.0005) and LOP(-1) (p = 0.0004) are also significant at the 1% level. Other variables have p-values greater than 0.05, indicating they are not statistically significant in explaining the dependent variable.

The results in Table 5 indicate that in the long run, oil prices (LOP) have a statistically significant positive effect on inflation (p = 0.0005), while past oil prices (LOP (-1)) have a significant negative impact (p = 0.0004). Exchange rate fluctuations (LEXH), interest rates (LINR), and unemployment (UNEP) do not exhibit significant long-run effects on inflation. In the short run, past inflation values play a critical role in determining current inflation, with the first lag (LINF(-1)) showing a strong positive impact (p = 0.0010) and the fourth lag (LINF(4)) demonstrating a significant negative effect (p = 0.0104). The error correction term (CointEq(1)) is negative and highly significant, confirming the model's validity in capturing long-term equilibrium relationships.

Asymmetric NARDL short-Run Results and Diagnostic Checks

Table 6: Coefficient Estimates of NARDL

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Significance
Constant	6.4328	1.6455	3.9092	0.0007	***
LINF(-1)	0.4470	0.1512	2.9558	0.0071	**
LINF(-2)	-0.3050	0.1932	-1.5780	0.1282	
LEXH	-0.0874	0.9050	-0.0960	0.9239	
LEXH(-1)	-1.9442	0.7647	-2.5422	0.0182	**
LINR	0.2123	0.2057	1.0321	0.3127	
LINR(-1)	-0.3056	0.2000	-1.5279	0.1402	
LINR(-2)	0.2928	0.1832	1.5987	0.1235	
LOP_POS	1.3710	0.3640	3.7580	0.0010	***
LOP_NEG	4.2357	1.3590	3.1166	0.0049	***
LOP_NEG(-1)	-3.0247	2.3722	-1.2750	0.2150	
LOP_NEG(-2)	-1.1676	2.6117	-0.4470	0.6590	
LOP_NEG(-3)	4.4110	2.4192	1.8233	0.0813	*
LOP_NEG(-4)	-6.5263	1.5661	-4.1671	0.0004	***
UNEP	-0.1268	0.0872	-1.4537	0.1595	
UNEP(-1)	-0.1492	0.0875	-1.7039	0.1019	*

Source: Authors' calculations.

From the results of Table 6, the NARDL model estimates the impact of various factors on inflation (LINF). The coefficient for LINF(-1) is positive (0.447), indicating a significant and positive relationship with inflation at a 1% significance level. Exchange rate fluctuations (LEXH) do not exhibit a direct significant impact on inflation, but its lagged value LEXH(-1) is negative and statistically significant at the 5% level ($p = 0.0182$), implying that past exchange rate movements negatively influence inflation. The interest rate (LINR) shows a positive but insignificant relationship with inflation, while its lagged values exhibit mixed effects but remain statistically insignificant. Oil price increases (LOP_POS) have a strong positive impact on inflation ($p = 0.0010$), while negative oil price shocks (LOP_NEG) also significantly influence inflation, with LOP_NEG(-4) demonstrating a highly significant negative impact ($p = 0.0004$). The unemployment rate (UNEP) does not seem to significantly impact inflation, as both its current and lagged coefficients are statistically insignificant. The constant term (C) is highly significant ($p = 0.0007$), suggesting the presence of other unaccounted factors influencing inflation. The model fit is strong, with an R-squared value of 0.89, indicating that 89% of the variation in inflation is explained by the model. The F-statistic is highly significant ($p = 0.0000$), confirming the overall validity of the model. The Durbin-Watson statistic (1.74) suggests no severe autocorrelation issues.

Overall, the results indicate that inflation dynamics in this model are significantly influenced by oil price movements and past inflation values, while the effects of exchange rates and interest rates remain mixed.

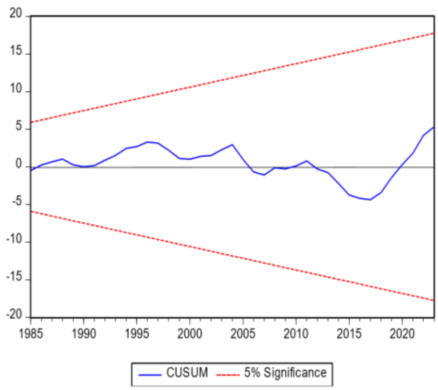
Table 7: Consolidated Diagnostic Tests Table

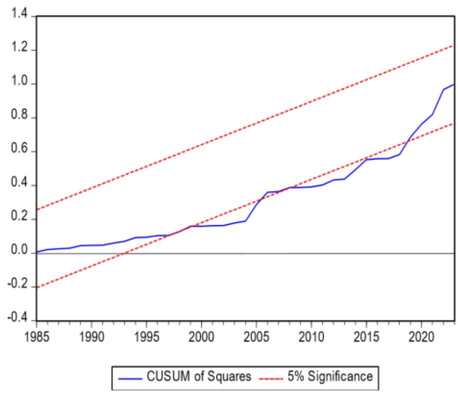
Test	Statistic(s)	p-value(s)	Interpretation	Conclusion (at 5% significance)
Normality (Jarque-Bera)	JB = 1.0449	0.5931	Residuals are symmetric; skewness ≈ -0.0007; kurtosis = 2.24	Residuals are normally distributed
Serial Correlation (Breusch-Godfrey LM Test)	F = 9.4890 Obs* R^2 = 14.9170	0.0005 0.0006	Serial correlation detected in residuals	Autocorrelation exists
Heteroskedasticity (Harvey Test)	F = 1.8767 Obs* R^2 = 7.1022	0.134 0.1306	No strong evidence of heteroskedasticity	Homoskedasticity assumed
Heteroskedasticity (White Test)	F = 1.6424 Obs* R^2 = 19.458	0.1261 0.1482	Interaction terms mostly insignificant	Homoskedasticity assumed
Heteroskedasticity (Glejser Test)	F = 2.142 Obs* R^2 = 7.9253	0.0939 0.0944	LINR variable is significant	Homoskedasticity assumed
Model Specification (Ramsey RESET Test)	t = 2.8116 F = 7.9051 LR = 8.3156	0.0078 0.0078 0.0039	Model is correctly specified	No misspecification detected
Stability (CUSUM & CUSUMSQ Tests)	—	—	CUSUM: Stable CUSUMSQ: Approaches boundary	Model stable (but variance may shift)

Source: Authors' calculations.

The diagnostic tests summarized in Table 7 provide a comprehensive evaluation of the estimated model's validity. The Jarque-Bera test indicates that the residuals are normally distributed ($p = 0.5931$), showing negligible skewness and a kurtosis value close to that of a normal distribution, which supports the assumption of normality. However, the Breusch-Godfrey LM test reveals significant serial correlation in the residuals ($p < 0.01$), indicating autocorrelation that may affect the efficiency of the estimates. The results from the Harvey, White, and Glejser tests suggest no strong evidence of heteroskedasticity (all p-values > 0.05), thus allowing the assumption of homoskedasticity to hold. The Ramsey RESET test confirms correct model specification (p = 0.0078), implying that the model does not suffer from omitted variable bias or functional form misspecification. Lastly, the CUSUM and CUSUMSQ stability tests show that the model remains structurally stable over time, although the variance in CUSUMSQ approaches the boundary, suggesting potential shifts in variance. Overall, while the model is well specified and stable, adjustments may be necessary to address the issue of autocorrelation.

Figure 1 Stability Diagnostic: CUSUM and CUSUMSQ Stability Test





Source: Authors' calculations.

The result of Figure 1 indicates that the model appears stable according to the CUSUM test, as the cumulative sum of residuals remains within the 5% significance bounds, suggesting no significant structural breaks in the coefficients. Although the CUSUMSQ test shows potential instability, with the line nearing the upper boundary in recent years, it is generally acceptable if at least one of the tests (CUSUM or CUSUMSQ) indicates stability. Therefore, the model can still be considered structurally stable, although further investigation may enhance its robustness.

5. Discussion

This study applied the Nonlinear Autoregressive Distributed Lag (NARDL) model to empirically assess the asymmetric relationship between oil price fluctuations and inflation in Pakistan. The results demonstrate a clear asymmetry: oil price increases exert a stronger and more immediate inflationary impact than price decreases. This reinforces Pakistan's macroeconomic vulnerability, particularly due to its dependence on imported oil. The analysis also reveals a significant role of exchange rate movements—specifically, past depreciation tends to intensify inflationary pressures, complicating inflation management. In contrast, traditional monetary and labor market indicators such as interest rates and unemployment did not show a statistically significant long-run effect on inflation. This suggests that inflationary pressures in Pakistan are more structurally rooted in external cost-push factors rather than purely domestic demand-side dynamics. The presence of a long-run equilibrium among variables, confirmed through the ARDL bounds test, along with the convergence behavior indicated by the Error Correction Model (ECM), affirms that inflation in Pakistan is responsive to both immediate shocks and lagged macroeconomic influences. The nonlinearity captured by the NARDL model highlights the necessity to re-evaluate the predictive and policy frameworks that rely on linear assumptions.

6. Theoretical Implications

This study contributes to the evolving theoretical discourse on asymmetric price transmission by empirically validating that oil price shocks do not influence inflation symmetrically. The use of the NARDL model strengthens the theoretical foundation for incorporating nonlinearity in inflation modeling, particularly in developing economies exposed to external shocks. It also challenges the effectiveness of traditional monetary theories that mainly rely on interest rate channels to control inflation. The findings suggest that external factors—especially oil prices and exchange rates—may override domestic policy instruments in influencing price levels. Therefore, macroeconomic models should be expanded to accommodate asymmetric and externally induced shocks to better reflect real-world inflationary dynamics.

7. Managerial Implications

From a policy management perspective, the study's findings highlight the urgent need for more robust and flexible inflation-targeting strategies in Pakistan. Policymakers must recognize the asymmetric pass-through effect of oil prices, where price increases have a significantly greater impact on inflation than price decreases. Consequently, inflation-control measures should be tailored to differentiate between the inflationary effects of oil price hikes and declines. Strategic responses may include enhancing energy subsidy frameworks during periods of rising oil prices to shield consumers from cost-push inflation, and encouraging investments in renewable and domestic energy sources to lessen the economy's reliance on imported oil. Additionally, stabilizing the exchange rate through prudent foreign exchange reserve management and bilateral trade agreements can help mitigate the inflationary impact of external shocks. Integrating macroprudential policies that specifically target imported inflation, while ensuring overall monetary stability, would further improve policy effectiveness. Most importantly, inflation-targeting frameworks must be redefined to incorporate external asymmetries, allowing for a more adaptive and responsive policy stance in the face of global price volatility.

8. Limitations and Recommendations for Future Research

The study, while providing valuable insights into the asymmetric impact of oil price fluctuations on inflation in Pakistan, faces several limitations that create opportunities for future research. First, it utilizes a limited set of macroeconomic variables—oil prices, exchange rates, interest rates, and unemployment—while omitting critical fiscal elements like government expenditure, taxation policies, and subsidies due to data constraints. Including these fiscal aspects in future studies could provide a more thorough understanding of inflation's structural foundations. Second, the study does not explicitly consider global oil supply chain disruptions or geopolitical events, such as OPEC decisions or regional conflicts, which significantly influence oil prices. These factors should be modeled using geopolitical risk indices or suitable dummy variables to enhance explanatory power.

Another key limitation is the use of annual time-series data, which may obscure short-term fluctuations and delay effects. Employing higher-frequency data, such as monthly or quarterly series, could reveal more detailed insights into the timing and magnitude of asymmetric inflationary responses. Additionally, the study treats inflation as a single aggregate measure, overlooking sector-specific inflation dynamics. Future research could analyze disaggregated inflation indices across sectors such as energy, transportation, and agriculture to identify which ones are most sensitive to oil price shocks. Furthermore, the research does not address regional variations within Pakistan, despite the likelihood that inflationary effects vary across provinces due to differences in industrial composition, energy dependence, and consumption behavior. Analyzing regional or provincial levels would be beneficial in crafting localized policy responses. Another limitation is the absence of behavioral or expectation-based variables, which can significantly shape inflation trends by influencing consumer and investor behavior. Future models could integrate inflation expectations using survey-based data or proxy indicators like media sentiment indices.

Lastly, the study focuses exclusively on Pakistan and does not include a comparative perspective. Comparing findings with other oil-importing developing countries could offer broader policy insights and highlight structural similarities or differences in how comparable economies experience and react to oil-induced inflation. Addressing these limitations in future research would not only strengthen the theoretical framework but also improve the practical relevance of the findings for policymakers.

9. Conclusion

This study provides robust empirical evidence of the asymmetric effects of oil price fluctuations on inflation in Pakistan, utilizing the NARDL econometric framework. The results reveal a clear sensitivity of inflation to rising oil prices, while the response to decreasing prices is significantly weaker. This asymmetry highlights Pakistan's structural vulnerability to external oil price shocks, largely resulting from its dependence on imported petroleum products and limited energy diversification.

Additionally, the depreciation of exchange rates exacerbates inflationary pressures, indicating a strong pass-through effect. In contrast, domestic indicators such as interest rates and unemployment show statistically insignificant long-run impacts on inflation, suggesting that conventional demand-side policies may have limited effectiveness in an externally driven inflationary environment.

From a policy perspective, these findings reinforce the need for:

- A proactive inflation-targeting regime that accounts for nonlinear effects.
- Strategic accumulation of foreign exchange reserves to cushion exchange rate shocks. Investment in renewable energy and domestic production to lessen dependence on imported oil.
- Fiscal coordination to align subsidies and taxation with external price trends.

Beyond the econometric evidence, the study promotes a broader macroeconomic framework that moves beyond linear policy responses. It advocates for adaptive, asymmetry-aware policymaking, particularly in emerging economies facing significant external volatility.

In essence, inflation in Pakistan cannot be understood—or managed—without acknowledging the asymmetric and exogenous nature of its key drivers. By incorporating asymmetry into both analysis and policy, this research establishes a foundation for more realistic and resilient economic management in the face of global energy shocks.

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Annexure

Diagnostic Tests

Normality Test

Jarque-Bera	**1.0449**
Probability	0.5931

The series follows a normal distribution at a 5% significance level.

Breusch-Godfrey Serial Correlation LM Test

Statistic	**Value**	**Probability**
F-Statistic	9.4890	0.0005
Obs*R-squared	14.9170	0.0006

$H0$: No Autocorrelation at 5% significance level.

Heteroskedasticity

Harvey Heteroskedasticity Test

Statistic	**Value**	**Probability**
F-statistic	1.8767	0.134
Obs*R-squared	7.1022	0.1306
Scaled explained SS	6.1779	0.1862

The Harvey heteroskedasticity test results indicate no strong evidence of heteroskedasticity at the 5% significance level, as the Prob. Chi-Square (0.1306) is greater than 0.05. The coefficients of LEXH and LOP are statistically significant, suggesting their impact on residual variance, while other variables do not show significant effects.

H_0: No heteroskedasticity at the 5% significance level.

White Heteroskedasticity Test

Statistic	**Value**	**Probability**
F-statistic	1.6424	0.1261
Obs*R-squared	19.458	0.1482
Scaled explained SS	9.5169	0.7966

The White heteroskedasticity test suggests no strong evidence of heteroskedasticity, as the Prob. Chi-Square (0.1482) is greater than 0.05. Most interaction and quadratic terms are not statistically significant.

H_0: No heteroskedasticity at the 5% significance level.

Glejser Heteroskedasticity Test

Statistic	Value	Probability
F-statistic	2.142	0.0939
Obs*R-squared	7.92533	0.0944
Scaled explained SS	5.67149	0.2251

The Glejser heteroskedasticity test results indicate no strong evidence of heteroskedasticity, as the Prob. Chi-Square (0.0944) is greater than 0.05. The variable **LINR** is statistically significant at the 5% level

H_0: No heteroskedasticity at the 5% significance level.

Stability Test

Ramsey reset test

Test Statistics			
Statistic	**Value**	**df**	**Probability**
t-statistic	2.8116	38	0.0078
F-statistic	7.9051	(1, 38)	0.0078
Likelihood ratio	8.3156	1	0.0039
F-test Summary			
Component	**Sum of Sq.**	**df**	**Mean Squares**
Test SSR	1.1541	1	1.1541
Restricted SSR	6.7021	39	0.1718
Unrestricted SSR	5.5479	38	0.146

Null: model is correctly specified
Alt: model is misspecified

Empirical Studies of Capital Structure in Different Countries

S. No	Authors	Year	Region/Country	Findings	Variable(s) Studied
1	Li & Guo	2022	BRICS Nations	Limited evidence of asymmetric effects of oil price shocks on inflation; unique situation in Pakistan.	Oil price shocks, inflation
2	Husaini & Lean	2021	Southeast Asia	Strong, positive impact of oil price shocks on inflation; relevant for Pakistan's economic structure.	Oil price shocks, inflation
3	Charfeddine & Barkat	2020	Qatar	Positive oil price shocks have a greater long-term impact on GDP and diversification than negative shocks.	Oil price shocks, GDP, economic diversification
4	Ali	2020	Developed & Emerging Countries	Oil price shocks drive inflation in both developed and emerging nations.	Oil price shocks, inflation
5	Deluna et al.	2021	Multiple Countries	Oil price shocks significantly drive short-term and long-term inflation trends.	Oil price shocks, short-term inflation, long-term inflation
6	Nasir et al.	2019	GCC Countries	Significant heterogeneity in oil price shocks' impact on inflation and GDP growth due to varying oil dependence.	Oil price shocks, inflation, GDP growth
7	Omolade et al.	2019	8 African Oil-Producing Countries	Drops in oil prices linked to inflation increases, emphasizing structural inflationary response.	Oil price shocks, inflation
8	Zivkov et al.	2019	Central & Eastern Europe	Slow transmission of oil price changes to inflation; 100% increase in oil prices raises inflation by 1–6%.	Oil price changes, inflation
9	Lacheheb & Sirag	2019	Algeria	Asymmetric effects of oil price increases and decreases on inflation.	Oil price changes, inflation
10	Kriskkumar & Naseem	2019	Malaysia	Asymmetric effects of oil prices on economic growth using ARDL and NARDL models.	Oil price changes, economic growth

S. No	Authors	Year	Region/Country	Findings	Variable(s) Studied
11	Pal & Mitra	2019	USA	Short-term asymmetric spillover effects of oil price changes on inflation; less pronounced long-term effects.	Oil price changes, short-term inflation
12	Gong & Lin	2018	China	Oil supply/demand shocks impact inflation differently, highlighting a nuanced relationship.	Oil supply shocks, demand shocks, inflation
13	Tiwari et al.	2019	Global	Oil price spillover effects on inflation have diminished over time.	Oil price spillovers, inflation
14	Choi et al.	2018	Global	A 10% rise in oil prices increases inflation by 0.4 percentage points, more significant for positive shocks.	Oil price shocks, inflation
15	Bala & Chin	2018	Algeria, Angola, Libya, Nigeria	Explored oil price changes and inflation relationships in these countries.	Oil price changes, inflation
16	Salisu et al.	2017	Multiple Countries	Non-linear relationship between oil prices and inflation in oil-exporting and importing countries.	Oil prices, inflation
17	Kelikume	2017	Nigeria	Oil price increases cause substantial inflation; decreases have lesser impact.	Oil price changes, inflation
18	Gbatu et al.	2017	Liberia	Oil price increases positively affect employment and capital intensity; declines harm GDP growth.	Oil price changes, employment, capital intensity, GDP growth
19	Al-Eitana & Al-Zeaud	2017	Jordan	Crude oil price volatility significantly impacts inflation.	Oil price volatility, inflation
20	Rangasamy	2017	South Africa	Petrol price changes Granger-cause inflation.	Petrol price changes, inflation
21	Anwar, Khan & Khan	2017	Pakistan	Oil prices had a significant positive impact on inflation (2002–2011).	Oil prices, inflation
22	Malik	2016	Pakistan	Long-term effects of oil price increases on inflation (1979–2014).	Oil price increases, inflation

S. No	Authors	Year	Region/Country	Findings	Variable(s) Studied
23	Jawad et al.	2017	Global	Financial crises shifted relationships between oil prices and economic variables.	Oil prices, economic uncertainty
24	Donayre & Wilmot	2016	Oil-Exporting Nations	Asymmetric effects of oil price shocks on oil-exporting economies.	Oil price shocks, economic performance
25	Gokmenoglu et al.	2016	Nigeria	Oil price fluctuations impact tourism demand and economic performance.	Oil price fluctuations, tourism demand, economic performance
26	Nusair	2016	Global	Asymmetric effects of oil price shocks using NARDL model.	Oil price shocks, inflation
27	Aziz & Dahalan	2015	Malaysia & Others	Panel VAR model showed significant oil price impact on economic performance.	Oil prices, economic performance
28	Nugent & Switek	2013	Oil Importing/Exporting Countries	Asymmetries observed; negative for importers, positive for exporters.	Oil prices, inflation, trade balance
29	Reboredo	2012	Global	Food price shifts not directly linked to oil cost increases; complex dynamics.	Oil prices, food prices
30	Baffes & Dennis	2013	Global	Oil prices directly influence food prices and inflation.	Oil prices, food prices, inflation