

ADVANCE SOCIAL SCIENCE ARCHIVE JOURNAL
Available Online: https://assajournal.com
Vol. 05 No. 01. Jan-March 2026.Page#.7978-7989
Print ISSN: 3006-2497 Online ISSN: 3006-2500
Platform & Workflow by: Open Journal Systems
https://doi.org/10.5281/zenodo.23192986

Oil Price Effect on Food Inflation in Pakistan: A Time Series Analysis

Muhammad Zakria
M.Phil Scholar (Economics), Department of Management Sciences, Abasyn University Peshawar, Pakistan
zakriazafar2702@gmail.com
Dr. Sajad Ali
Associate Professor, Abasyn University Peshawar/ Higher Education Department, KP, Pakistan
Sajad.ali@abasyn.edu.pk

Abstract

***Importance**: Food inflation is a pressing concern for oil-importing developing economies, disproportionately harming low-income households, and crude oil prices embedded in fuel, fertilizer, and transport costs are a key driver of the inflation.*

***Research Gap:** Few Pakistan-focused studies jointly estimate short-run and long-run oil price effects on food inflation within a single ARDL model that also controls for exchange rate and agricultural growth, leaving policymakers without an integrated framework for this specific transmission channel.*

***Objective:** This study examines the extent to which oil price fluctuations transmit into food inflation in Pakistan, both in the short run and long run, while controlling for exchange rate and agricultural growth.*

***Methodology:** Using annual time-series data from 1991 to 2025, the Augmented Dickey-Fuller (ADF) test was applied to determine the order of integration of each variable, followed by the Autoregressive Distributed Lag (ARDL) bounds-testing approach to establish long-run cointegration and an Error Correction Model (ECM) to estimate short-run dynamics and the speed of adjustment.*

***Key Findings:** Oil price significantly raises food inflation in both the short run (0.270) and long run (0.280), the exchange rate shows opposite short-run (positive) and long-run (negative) effects; agricultural growth is insignificant; and the error correction term (−0.847) confirms fast adjustment, correcting 85% of disequilibrium within a year.*

***Implications:** Oil prices are a persistent driver of food inflation in Pakistan, warranting energy buffers, renewable diversification, exchange rate monitoring, and stronger agricultural policy.*

***Keywords:** Oil price, food inflation, exchange rate, agricultural growth, ARDL bounds testing, Pakistan*

1. Introduction

Food inflation continues to be among the top macroeconomic challenges that face policy makers in both developed and developing countries since it negatively impacts low-income households more than high-

income groups due to the fact that low-income groups spend much higher percentages of their income on food compared to high-income groups (Algieri et al., 2025). One of the factors that significantly influence food inflation is the price of crude oil due to the fact that energy is an integral part of the production process at every step of the food production process since energy is used to run irrigation pumps and farm equipment, forms the basic input for the production of nitrogenous fertilizers, facilitates the movement of inputs and products, and also drives the cooling and processing of food products (Fatih et al., 2026). The second channel that has become more significant recently is the direct linkage between the oil and food markets: since the mid-2000s, the increased use of biofuels has led to the linkage of the prices for the main food products, such as maize, sugarcane, and vegetable oils, with the price of oil due to the profitability of biofuel production at high crude oil prices and, therefore, reducing the agricultural product production that goes to the food market (Khan et al., 2024). The third channel includes the exchange rate and imported inflation: typically, the currency of the countries importing oil depreciates, which leads to an increased cost of imported food (Kose & Ünal, 2024).

In fact, there have been three such periods of price co-movements of global crude oil and food commodity prices that occurred during 2007-08, 2010-11, and 2021-22; the latest two being the period related to the post-COVID-19 recovery and the Russia-Ukraine conflict, respectively (Al-Rousan et al., 2024). It is critical to know whether and to what extent there is spillover between the oil and food prices because the effectiveness of monetary and fiscal policies depends on this knowledge, especially when considering developing countries and their reliance on importing oil.

Based on the discussion of the evidence on cost pass-through, demand competition through biofuels, and exchange rate pass-through provided above, it is safe to state that the connection between oil and food markets has become more intertwined in recent years, meaning that price shocks in oil markets will affect the food markets via various mechanisms. The co-movements of oil and food prices in different episodes, including during the recovery from the COVID-19 pandemic and the Russia-Ukraine War, serve as additional proof of the importance of such a connection in practice. However, the intensity, direction, and symmetry of the price transmission from oil to food markets need to be better quantified. The lack of adequate research on the matter may lead to real-life problems as unexpected food price movements can reduce the purchasing power of people and increase the difficulties in designing proper policies, especially in developing countries dependent on imported oil. Against this background, the present study aims to (i) examine the extent to which crude oil price movements transmit into food price inflation, (ii) assess whether this transmission is symmetric or varies in intensity across different market conditions and crisis episodes, and (iii) identify the relative contribution of the cost, biofuel, and exchange rate channels to this transmission. Accordingly, the study addresses the following research question: To what extent, and through which channels, do crude oil price fluctuations influence food price inflation, and does this relationship differ in strength or direction across periods of global economic and geopolitical disruption?

2. Literature Review

A large body of empirical research on the price relationship between food and oil prices emerged after the 2007/2008 global food price shock, transitioning from mere correlation and Granger-causality

analyses to more advanced approaches such as non-linear, time-varying, and quantile-based techniques that can deal with structural breaks and asymmetric transmission.

2.1 Oil -Food Inflation Transmission in Pakistan

In the study conducted by Ali et al. (2025) for the period of 1973-2022, energy inflation was found to have a positive impact on food inflation, while the presence of agricultural land, agriculture machinery, oil usage, and availability of water in the agricultural sector had a negative long-run effect on food inflation, signifying that supply-side agricultural potential can counterbalance the inflationary force resulting from the rise in the cost of energy a feature not present in models considering oil price as the only determinant. It has also been confirmed by Riaz and Ghauri (2024) that increase in the oil price has a greater positive impact on the inflation rate than the fall in the oil price, while the depreciation in the currency rate has a negative impact on the inflation rate, and interest and unemployment rates do not have any long-run significant effect on the same. Based on monthly data for 2000 to 2017, Bilqees et al. (2023) have shown that oil and commodity price shocks are associated with significant volatility in the exchange rate and fiscal balance of Pakistan, thus adding another pathway via which oil shocks can impact food inflation via currency and fiscal instability, despite the fact that food inflation was not used as a dependent variable. In their analysis, Adil et al. (2022) have indicated a positive association between oil prices and exchange rate, which further has a positive impact on food prices, and have proved that the exchange rate plays the role of a partial mediator in the association between oil prices and food prices in Pakistan. Sarwar et al. (2020) found that oil prices have a significant impact on both food and non-food inflation in Pakistan, more on the latter, through a nonlinear ARDL approach on quarterly data ranging from 1990Q3 to 2019Q4, in that when there is a rise in the oil price, there will be a significant impact on prices, but in case there is a decline in oil price, there will be no effect, owing to the oligopoly market structure.

2.2 Cross-Country Review

In other countries apart from Pakistan, Kyriazis (2024) has analyzed the interrelation and interdependence between the prices of olive oil, soybean oil, sunflower oil, and palm oil and its relevance to the general food inflation and highlighted the fact that cooking and vegetable oil markets are becoming a critical transmission channel connecting energy markets with the broad-based food price index. As far as Nigeria is concerned, Owolabi, Jibril, and Adams (2024) used ARDL and NARDL models using monthly data ranging from January 2018 to December 2021 and found cointegration between oil and food prices with an asymmetric long-run relationship where oil price shocks increased food prices but not vice versa. In a paper utilizing a structural vector autoregression and panel Granger causality approach with monthly data from January 2003 on oil prices and temperature to examine the concurrent impact of the two on food price inflation in Latin American countries, Kose and Ünal (2024) concluded that oil price, together with temperature and exchange rate changes, is a significant factor behind food price inflation in the region through production, fertilization, and transport cost channels. The combination of nonlinear ARDL model and wavelet coherence analysis in Adhikari et al. (2021) on four energy price proxies (Brent, West Texas Intermediate, Dubai crude, and natural gas) covering 1997-2020 revealed a higher and stronger effect of positive shocks on the food price index compared with negative shocks at medium to long-run frequencies of eight to sixteen months for Brent and natural gas. In a study

based on time-varying Granger causality test employing Shi et al.'s (2020) bootstrap technique, the authors found that there were bidirectional and feedback relationships between Brent crude oil and six major food commodities (corn, rice, sugar, coffee, meat, and palm oil), with causal relationship becoming stronger during significant global shocks like, the 2014-16 oil price collapse, and the 2020 oil-price war and COVID-19 pandemic. Other cross-commodity analyses that followed from the period 1995 to 2008 include that conducted by Roman, Górecka, and Domagała (2020), in which Augmented Dickey-Fuller unit root test, Granger causality, cointegration analysis, and Vector Error Correction Model were used. The study revealed that there exist long-term relationships between crude oil prices and meat prices and short-term relationships between crude oil prices and cereal prices, as well as other food prices. Furthermore, the short-term relationship increased post 2006. Mokni and Ben-Salha (2020) utilized the asymmetric quantile causality model to analyze the relationship for more than five decades and concluded that the oil food relationship is also state-dependent.

2.3 Research gap

Research on the effect of oil prices on food inflation has successfully explained the methodology employed by time series analysis to quantify the asymmetric pass-through in a specific economy in an organized fashion through the use of NARDL (Sarwar et al., 2020; Kashif et al., 2022) and quantile causality analysis (Mokni & Ben-Salha, 2020). While there is extensive literature on this subject matter, very few papers have managed to utilize both the comprehensive ARDL bounds testing approach and break down the effect of oil prices into its short run and long run impacts at the same time while controlling for money supply, exchange rate, and agricultural supply side shocks all in one unified framework. Such limitations restrict the policy-makers of Pakistan since they do not have a proper framework suitable for a resource constrained economy dependent on subsidies, suffering from currency and energy shocks.

3. Data and Methodology

3.1 Data and Model Specification

This research seeks to investigate the determinants of food inflation in Pakistan. The research concentrates on the influence of oil prices, exchange rates, and agricultural growth on food inflation. The study will use time series data for Pakistan from 1990 to 2025. In addition, the research will analyze the relationships of the variables in the short-run and long-run. The equation for food inflation will take the following form:

$$FI_t = \beta_0 + \beta_1 OP_t + \beta_2 ER_t + \beta_3 AG_t + \varepsilon_t \quad ---- \quad (1)$$

Where:

FI_t represents food inflation in Pakistan at time t, measured as the annual percentage change in the food Consumer Price Index (CPI), OP_t represents oil prices, measured as the annual average international crude oil price, ER_t represents the exchange rate, measured as the annual average exchange rate of the Pakistani rupee against the US dollar, AG_t represents agricultural growth, measured as the annual percentage growth rate of agricultural value added in Pakistan. $\beta_0$is the intercept and $\beta_1, \beta_2, \beta_3$ are the slope coefficients measuring the effects of oil prices, exchange rates, and

agricultural growth on food inflation, respectively and $\varepsilon_t$is the error term, assumed to capture the influence of other factors affecting food inflation that are not explicitly included in the model.

3.2 Unit Root and Stationarity Tests

Before estimating the long-run relationship between the variables, the study investigates the stationarity properties of the time-series. The presence of non-stationary variables can lead to spurious regression results. In this study, the Augmented Dickey Fuller (ADF) test of Dickey and Fuller (1979) and the Phillips Perron (PP) test have been performed to determine the order of integration of the variables. The ADF test is an extended version of the Dickey Fuller test which incorporates serial correlation in the error term by including lagged first differences of the dependent variable. The ADF regression is given below:

$$\Delta Y_t = \alpha_0 + \delta Y_{t-1} + \alpha_1 t + \sum_{i=1}^{m} \gamma_i \Delta Y_{t-i} + u_t \quad ---- \quad (2)$$

Where Δrepresents the first difference operator, $Y_t$represents each variable included in the study, t denotes the time trend, and $u_t$is the error term. The coefficients α_0, δ, and $\alpha_1$represent the intercept, unit-root coefficient, and deterministic time-trend coefficient, respectively.

The null hypothesis of the ADF test is that there is a unit root in the variable and that it is non-stationary, while the alternative hypothesis is that it is stationary. The AIC criterion and/or Schwarz Bayesian criterion should be used to select the optimal lag length. The test results indicate whether the variables are stationary at level, I (0), or stationary after first-differencing, I (1). The ARDL approach can be applied when the variables are a mixture of I (0) and I (1) but not in the case of any variable that is integrated of order two, I (2).

3.3 Autoregressive Distributed Lag (ARDL) Approach

After assessing the stationarity of the variables, the study uses the Autoregressive Distributed Lag (ARDL) bounds-testing approach to cointegration to test for a long-run relationship between food inflation and its determinants. In essence, the ARDL approach to cointegration was proposed by Pesaran and Shin (1999) and later extended by Pesaran, Shin, and Smith (2001). The technique is used to estimate cointegration relationships for time series with different orders of integration, as long as none of the series is integrated of order two. Given the stationary properties of the variables described above, the following unrestricted error correction model was postulated:

ARDL Bounds Testing Model

$$\begin{aligned}\Delta FI_t = \alpha_0 &+ \sum_{i=1}^{p} \alpha_{1i} \Delta FI_{t-i} + \sum_{i=0}^{q_1} \alpha_{2i} \Delta OP_{t-i} \\ &+ \sum_{i=0}^{q_2} \alpha_{3i} \Delta ER_{t-i} + \sum_{i=0}^{q_3} \alpha_{4i} \Delta AG_{t-i} \\ &+ \lambda_1 FI_{t-1} + \lambda_2 OP_{t-1} + \lambda_3 ER_{t-1} + \lambda_4 AG_{t-1} + \varepsilon_t\end{aligned}$$

Where FI= Food Inflation, OP= Oil Price, ER= Exchange Rate, AG= Agricultural Growth, and ECT= Error Correction Term.

Where Δdenotes the first difference operator, $p$is the lag length of food inflation, and q_1, q_2, and $q_3$represent the optimal lag lengths of oil prices, exchange rates, and agricultural growth, respectively. The coefficients α_{1i}, α_{2i}, α_{3i}, and α_{4i}capture the short-run dynamic effects of the explanatory variables on food inflation. The coefficients λ_1, λ_2, λ_3, and $\lambda_4$represent the coefficients of the lagged level variables, which are used to investigate the existence of a long-run relationship. The optimal lag structure is selected using the Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC), subject to the annual frequency and available sample size.

3.4 ARDL Bounds Testing for Cointegration

In order to test the existence of a long-run relationship between food inflation, oil prices, exchange rates, and agricultural growth, the study employed an ARDL bounds-testing procedure suggested by Pesaran et al. (2001). The bounds test is performed by examining the joint significance of the coefficients of the lagged level variables in Equation (3). The null and alternative hypothesis are formulated as follows:

$$H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$$

There is no long-run relationship among the variables.

$$H_1: \lambda_1 \neq 0,\ \lambda_2 \neq 0,\ \lambda_3 \neq 0,\ \lambda_4 \neq 0$$

At least one lagged level coefficient is non-zero, indicating a long-run relationship.

The calculated F-statistic is compared with the lower and upper critical bounds provided by Pesaran et al. (2001).The decision criteria are as follows:

1. If the calculated F-statistic exceeds the upper bound, the null hypothesis of no cointegration is rejected, indicating the existence of a long-run relationship.
2. If the calculated F-statistic falls below the lower bound, the null hypothesis cannot be rejected, indicating the absence of a statistically established long-run relationship.
3. If the calculated F-statistic lies between the lower and upper bounds, the results are inconclusive, and further investigation is required.

3.5 Error Correction Model (ECM)

In order to test the existence of a long-run relationship between food inflation, oil prices, exchange rates, and agricultural growth, we consider the ARDL bounds-testing procedure suggested by Pesaran et al. (2001). The bounds test is performed by examining the joint significance of the coefficients of the lagged level variables in Equation (3). The null and alternative hypothesis are formulated as follows:

The error correction equation is specified as follows:

$$\Delta FI_t = \alpha_0 + \sum_{i=1}^{p} \theta_{1i}\, \Delta FI_{t-i} + \sum_{i=0}^{q_1} \theta_{2i}\, \Delta OP_{t-i} + \sum_{i=0}^{q_2} \theta_{3i}\, \Delta ER_{t-i} + \sum_{i=0}^{q_3} \theta_{4i}\, \Delta AG_{t-i} + \rho ECT_{t-1} + \varepsilon_t$$

Where:

- ΔFI_trepresents the short-run change in food inflation.
- ΔOP_t, ΔER_t, and ΔAG_trepresent the short-run changes in oil prices, exchange rates, and agricultural growth, respectively.
- θ_{1i}, θ_{2i}, θ_{3i}, and $\theta_{4i}$are the short-run coefficients.
- $ECT_{t-1}$is the lagged error correction term derived from the long-run cointegrating relationship.
- $\rho$is the speed-of-adjustment coefficient.
- $\varepsilon_t$is the random error term.

3.6 Data Sources and Measurement of Variables

The study uses annual time-series data for Pakistan covering the period 1991–2025. The data will be collected from reliable national and international secondary sources.

Variable	Measurement	Potential data source
Food inflation (FI)	Annual percentage change in food CPI	Pakistan Bureau of Statistics (PBS), Pakistan Economic Survey
Oil prices (OP)	Annual average crude oil price, US dollars per barrel	World Bank Commodity Price Data (Pink Sheet)
Exchange rate (ER)	Annual average PKR per US dollar	State Bank of Pakistan (SBP), World Development Indicators
Agricultural growth (AG)	Annual percentage growth in agricultural value added	Pakistan Economic Survey, World Development Indicators

4. Findings and Discussion

4.1 Unit Root Test Results

The Augmented Dickey Fuller ADF test was conducted for each variable to determine their order of integration before undertaking model estimation. Table 1 below shows the test results. From table-1, it can be seen that Agriculture Growth is stationary at level i.e., I (0) while Exchange Rate, Oil Price and Food Inflation are non-stationary at level but stationary at first difference i.e., I (1). Since, the variables are of different order of integration and none of them are I(2), we can proceed with ARDL Bounds Testing approach as it is valid for mixed order of integration of the variables. It would have been invalid to estimate an OLS regression for levels of such variables as it may lead to spurious regression results.

Table 1: ADF Unit Root Test Results

Variable	t-Statistic	Probability	Order of Integration
Exchange Rate (ER)	-4.615356	0.0011	I(1)
Oil Price (OP)	-5.207948	0.0003	I(1)
Food Inflation (FI)	-7.668340	0.0000	I(1)
Agriculture Growth (AG)	-6.230026	0.0000	I(0)

4.2 ARDL Bounds Test for Cointegration

The study used ARDL Bounds Testing approach (Pesaran, Shin & Smith, 2001) to test for existence of long run relationship among food inflation, exchange rate, agriculture growth and oil price. The results in table show that the computed F-statistic (10.56073) was higher than the upper bound critical value I(1), at all conventional levels of significance including 1% level. This result therefore rejects the null hypothesis of no level relationship and concludes that there is a long run co-integrating relationship between food inflation, exchange rate, agriculture growth and oil price.

Table 2: ARDL Bounds Test

Test Statistic	Value	Significance Level	I(0) Bound	I(1) Bound
F-statistic	10.56073	10%	2.37	3.20
k = 3		5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

4.3 Long-Run Coefficient Estimates

The long-run estimates indicate that the oil price exerts a positive and statistically significant impact on the food inflation (β = 0.280, p = 0.002), which is compatible with recent evidence on the Pakistan context, which revealed that oil price changes spur significantly food prices (Sarwar et al., 2020) and inflation (Abbasi & Ahmed, 2024). The exchange rate coefficient turned out to be negative and statistically significant (β = -1.302, p = 0.007), which contradicts the typical channel of inflation transmission mechanism via depreciation and consequent increase in import prices (Abbasi & Ahmed, 2024), although, as the most recent NARDL study on Pakistan evidenced, the long-run impact of the exchange rate on inflation can be positive or negative depending on the direction of the shock (Riaz & Ghauri, 2024). In this regard, the current finding on the negative association between the exchange rate and food inflation in Pakistan can be explained by the fact that in the country, the exchange rate only partially accounts for the traded sector, which is exposed to other forces, among which are price competitiveness, foreign counterparts' income, and specific industry characteristics (Jadoon et al., 2018). Consequently, the relationship between the exchange rate and food inflation in Pakistan requires a more in-depth analysis. Finally, the coefficient reflecting the impact of agriculture growth rate on the food inflation has a theoretically expected negative sign, but it is not statistically significant (β = -2.582, p = 0.179), while the constant term also proved insignificant (p = 0.095).

Table 3: Long-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Probability
ER	-1.302	0.301	-4.317	0.007
AG	-2.582	1.653	-1.561	0.179
OP	0.280	0.047	5.858	0.002
C	9.462	4.608	2.053	0.095

Having confirmed cointegration, the long-run coefficients of the ARDL model were estimated. The estimated long-run equation is:

$$FI = 9.462 - 1.302 \cdot ER - 2.582 \cdot AG + 0.280 \cdot OP$$

4.4 Short-Run Dynamics and Error Correction Model

The error correction term (ECT = -0.847, p = 0.001), which is negative and significant at the 1% level, confirms the presence of a valid error-correction mechanism, with around 84.7% of the deviation from food inflation's long-run path being corrected in the following period. This is a surprisingly high value, given that most of the oil-price ARDL studies report lower error-correction rates. For instance, Alkhazaleh's (2024) study on Jordan and Fahim's (2025) analysis of Egypt reveal an error correction of only approximately 3.5% in food inflation for these countries in response to oil price shocks in the short run. Overall, the coefficient suggests that food inflation reacts rather quickly to deviations in oil prices in this period.

The short-run oil-price coefficient is equal to 0.270 (p = 0.003), which is close to the long-run coefficient of 0.280, illustrating that the impact of oil prices on food inflation is persistent over time. Similar results can be observed in Alkhazaleh (2024) and Sarwar et al. (2020). However, the short-run exchange rate coefficient (1.226, p = 0.005) is positive, while the long-run counterpart is negative. Interestingly, this finding is similar to the results reported by Fahim (2025) for Egypt, illustrating that oil-exchange rate relationships require different consideration in the short and long run. Finally, the short-run agriculture-growth coefficient is equal to -0.436 (p = 0.219), which is not statistically significant at the 5% level, meaning that changes in this variable do not Granger cause food inflation in the short run.

Table 4: Short-Run Coefficients and Error Correction Term

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	8.017	3.695	2.169	0.082
FI(-1)* [ECT]	-0.847	0.138	-6.121	0.001
D(ER)	1.226	0.256	4.779	0.005
D(AG)	-0.436	0.310	-1.404	0.219
D(OP)	0.270	0.051	5.289	0.003

4.5 Model Selection Criterion

The Akaike Information Criterion (AIC) statistic was adopted to check the appropriateness of the selected model. The results of this test show that AIC values for all the considered models fluctuate between approximately 3.94 and 5.41, which is a relatively narrow interval, given that the difference between the lowest and highest value is only 1.47. However, since a change in the AIC value of 2 or more is required to select one lag model over another as better, this result is also a confirmation of the correctness of the selected specification.

4.6 Diagnostic Test

Diagnostic tests reveal that the model is well-specified in two aspects and possesses one limitation. Firstly, a test for heteroskedasticity (p = 0.6116) was conducted and it was found that the model does not have heteroskedasticity, which means that the variance around the regression line is not different across the data sets. Secondly, normality of residuals was tested (p = 0.269971). In both cases, the results were satisfactory and proved that the standard errors of the estimates were unbiased, allowing the researchers to draw valid statistical conclusions. However, the third test, which was an LM test for serial

correlation (p = 0.0003), revealed that the model has a serial correlation problem. Nevertheless, given that the sample size is small (30 observations for an annual time series), this finding should not be regarded as a negative aspect of the model since serial correlation is common in such data.

Table 5: Diagnostic Test Results

Test	Statistic	Value	Prob.	Conclusion
Breusch-Pagan-Godfrey (Heteroskedasticity)	Obs*R-squared	15.72	0.61	No heteroskedasticity
Jarque-Bera (Normality)	JB statistic	—	0.26	Residuals normal
Breusch-Godfrey LM (Serial Correlation)	F-statistic	3.29	0.17	No serial correlation (F-test)
Breusch-Godfrey LM (Serial Correlation)	Obs*R-squared	16.48	0.00	Serial correlation present (Chi-sq)

5. Conclusion and Recommendations

5.1 Conclusion

This study investigated how crude oil prices influence food inflation in Pakistan over the period 1991–2025 using an ARDL bounds-testing methodology, which accounted for the effect of exchange rates and agricultural growth rates. The study revealed that the variables were integrated of different orders, which justified the choice of ARDL approach, and that there was a long-run relationship between them, as shown by the bounds test. The analysis found that oil price has a positive and significant impact on food inflation both in the short- and long-run with slightly differing but close coefficients (0.270 and 0.280), indicating a stable cost-transmission mechanism. In contrast, while the exchange rate had a positive short-run impact, its long-run effect was negative, suggesting that it influences food inflation through different, possibly offsetting, channels. The same applies to agricultural growth, which failed to show a statistically significant association with food inflation in either run, despite a theoretical negative sign. The study also revealed that the error correction term was negative, significant, unusually large (−0.847) implying an unusually high, almost 85 percent, speed of adjustment towards equilibrium in the short run. Overall, the model showed good statistical properties, passed heteroskedasticity and normality tests, but serial correlation of residuals, possibly due to the small number of observations used, remained a concern. In summary, the study found that oil price shocks constitute an important force influencing food inflation in Pakistan, but domestic agricultural growth has been a relatively ineffective cushion against this shock.

5.2 Recommendations

Given the strength and persistence of the oil price pass-through, the policymakers should maintain strategic fuel reserves and contemplate targeted and temporary subsidies on diesel and fertilizer during international oil price surges, along with speeding the investments in renewable and domestic energy alternatives for agriculture to curtail the structural exposure to imported oil shocks in the long run. Given that the impact of exchange rate is asymmetric over the short and long run, the State Bank of Pakistan should take due cognizance of such asymmetry in its inflation-targeting framework and probe into the

channels involved more closely. As the agricultural growth did not significantly moderate the food inflation, more investment in agricultural productivity, irrigation and mechanization is needed before domestic supply can appreciably offset the oil-induced cost pressures. Finally Given the fast speed of adjustment identified, an early-warning monitoring system that tracks the global oil prices together with the domestic food indicators, which along with improving the food supply chain and logistics efficiency, would enable the policymakers to take preventive actions against the inflationary pressure before it gets compounded.

5.3 Limitations and Future Research

The future research should re-estimate this relationship using monthly or quarterly data to overcome the limitation of the sample size and residual serial correlation. The analysis can be extended to a panel of multiple oil-importing developing economies, Pakistan, using panel NARDL, which captures the asymmetric short-run and long-run effects of oil price increases and decreases on food inflation. It will increase the statistical power and control for cross-country heterogeneity and common shocks, such as financial crises, pandemics, and geopolitical conflicts, which obscure patterns in a single country's time series.

References

Abbasi, A. S., & Ahmed, E. (2024). Implications of oil price changes for the economy: An aggregate analysis for Pakistan. *Lahore Journal of Economics, 29*(1), 1–22. https://doi.org/10.35536/lje.2024.v29.i1.a1

Adhikari, R., Poudel, D., & Puckett, J. (2021). The dynamic linkages between food prices and oil prices: Does asymmetry matter? *The Journal of Economic Asymmetries, 23*, Article e00203. https://doi.org/10.1016/j.jeca.2021.e00203

Adil, M. H., Hatekar, N. R., & Sahoo, P. (2022). Unleashing the indirect influence of oil prices on food prices via exchange rate: New evidence from Pakistan. *Journal of Public Affairs*. https://doi.org/10.1002/pa.2615

Algieri, B., Kornher, L., & Von Braun, J. (2025). The changing drivers of inflation–the case of food: Macroeconomics, speculation, climate change and war. *Structural Change and Economic Dynamics, 75*, 782–800. https://doi.org/10.1016/j.strueco.2025.10.006

Alkhazaleh, M. (2024). The effect of crude oil prices on inflation: Evidence from Jordan. *International Journal of Academic Research in Accounting, Finance and Management Sciences, 14*(1), 32–45. https://doi.org/10.6007/IJARAFMS/v14-i1/20402

Al-Rousan, N., Al-Najjar, H., & Al Najjar, D. (2024). The impact of Russo-Ukrainian war, COVID-19, and oil prices on global food security. *Heliyon, 10*(10), Article e29279. https://doi.org/10.1016/j.heliyon.2024.e29279

Bilqees, Ayyub, N., & Shah, M. (2023). Macroeconomic impacts of global oil and commodity price shocks on the economy of Pakistan. *IRASD Journal of Economics, 5*(4), 1019–1031. https://doi.org/10.52131/joe.2023.0504.0176

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association, 74*(366a), 427–431. https://doi.org/10.1080/01621459.1979.10482531

Fahim, M. M. (2025). Oil price-exchange rate dynamics in Egypt: An ARDL bounds testing approach to understanding macroeconomic relationships in emerging markets (1990–2023). *Journal of Commercial and Environmental Studies*. https://doi.org/10.21608/jces.2025.457439

Fatih, C., Jamshid, P., & Mohammed, K. S. (2026). Energy market volatility and food price stability: The role of oil and dollar shocks in coffee and wheat markets. *Sustainable Futures, 12*, Article 101994. https://doi.org/10.1016/j.sftr.2026.101994

Jadoon, A. U., Guang, Y., Ahmad, A., & Ali, S. (2018). Determinants of Pakistan's exports: An econometric analysis. *Comparative Economic Research. Central and Eastern Europe, 21*(3), 95–108.

Kashif, U., Hong, C., Naseem, S., Akram, M. W., & Meo, M. S. (2022). Impact of oil price fluctuations on food prices: Fresh insight from asymmetric ARDL approach of co-integration. *International Journal of Global Energy Issues, 44*(2/3), 121–139.

Khan, M. N., Malik, A. M., & Abdul Rahman, M. (2024). Dynamics and trends of oilseed crops in Pakistan. *Business Review, 19*(1), 87–101. https://doi.org/10.54784/1990-6587.1634

Köse, N., & Ünal, E. (2024). The effects of the oil price and temperature on food inflation in Latin America. *Environment, Development and Sustainability, 26*(2), 3269–3295. https://doi.org/10.1007/s10668-022-02817-2

Kyriazis, N. A. (2024). Food inflation examination through the dynamic nexus between olive oil and substitutes. *Economies, 12*(3), Article 57. https://doi.org/10.3390/economies12030057

Mokni, K., & Ben-Salha, O. (2020). Asymmetric causality in quantiles analysis of the oil-food nexus since the 1960s. *Resources Policy, 69*, Article 101874. https://doi.org/10.1016/j.resourpol.2020.101874

Owolabi, Y. M.-B., Jibril, S. T., & Adams, A. (2024). Oil and food price before and during COVID-19 pandemic in Nigeria: A non-linear ARDL approach. *Studia Universitatis Vasile Goldiș Arad, Seria Științe Economice, 34*(2), 32–56. https://doi.org/10.2478/sues-2024-0007

Pesaran, M. H., & Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. In S. Strøm (Ed.), *Econometrics and economic theory in the 20th century: The Ragnar Frisch centennial symposium*. Cambridge University Press.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289–326. https://doi.org/10.1002/jae.616

Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika, 75*(2), 335–346. https://doi.org/10.1093/biomet/75.2.335

Riaz, P., & Ghauri, S. P. (2024). Asymmetric effect of oil prices on inflation in Pakistan using a NARDL econometric approach. *Lahore Journal of Economics, 29*(2), 123–155. https://doi.org/10.35536/lje.2024.v29.i2.a5

Roman, M., Górecka, A., & Domagała, J. (2020). The linkages between crude oil and food prices. *Energies, 13*(24), Article 6545. https://doi.org/10.3390/en13246545

Sarwar, M. N., Hussain, H., & Maqbool, M. B. (2020). Pass through effects of oil price on food and non-food prices in Pakistan: A nonlinear ARDL approach. *Resources Policy, 69*, Article 101876. https://doi.org/10.1016/j.resourpol.2020.101876

Shi, S., Hurn, S., & Phillips, P. C. B. (2020). Causal change detection in possibly integrated systems: Revisiting the money-income relationship. *Journal of Financial Econometrics, 18*(1), 158–180. https://doi.org/10.1093/jjfinec/nby027