



Impact of Oil Price Shocks on Pakistan's Trade Balance

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ABSTRACT

This paper examines the effect of international oil price shocks on Pakistan's trade balance for the time period 1995–2024. The price volatility of petroleum products and oil prices generally is a big hurdle in the external sector stability of Pakistan which is heavily relying on petroleum products imports. The study utilizes annual time series data from the World Bank, the International Monetary Fund, the State Bank of Pakistan and the U.S. Energy Information Administration, to test both short-run and long-run relationships through the bounds testing specification; the autoregressive distributed lag (ARDL) model. The findings reveal the existence of a stable long-run cointegrating relationship among the variables. International oil price shocks exert a significant negative effect on Pakistan's trade balance in both the short and long run. Exchange rate depreciation further deteriorates the trade balance, while higher foreign exchange reserves help mitigate external vulnerabilities. The study recommends energy diversification, export expansion, prudent reserve management, and policies aimed at reducing dependence on imported oil to enhance Pakistan's external sector resilience.

Introduction

International oil price volatility has emerged as one of the major sources of macroeconomic uncertainty in the global economy. As crude oil remains a crucial input in transportation, manufacturing, electricity generation, and industrial production, fluctuations in oil prices have far-reaching implementation for both developed and developing economies. Specifically, oil-importing countries are highly susceptible to external energy price shocks because rise in international oil prices raise production costs, intensify inflationary pressures and deteriorate external sector balances. That's why, understanding the transmission mechanisms through which oil price shocks influence trade performance has become a vital area of inquiry in international economics.

Theoretical and empirical literature tells that oil price shocks affect an economy via multiple channels. The increase in international oil prices raises the import bill of oil-dependent economies, that worsening the trade balance and increasing current account deficits. Higher energy costs also reduce firms' competitiveness by increasing the cost of production, which may directly affect exports. Furthermore, higher oil import payments also increase the demand for foreign currency, putting downward pressure on domestic exchange rates, and increasing the balance of payments vulnerabilities. These links suggest that the volatility of oil prices affects the internal economic dynamics of the country and shape the external economic adjustment process in an economy.

Looking back at the past, there were instances of sudden oil price fluctuations, which emphasized the significance of energy market developments in ensuring economic stability. Oil shocks of the 1970s demonstrated the impact of oil interruption in

global supply on slowing up the economy and sparking up inflation in states. The past few years have also seen significant volatility at international energy markets, as the commodity price boom of 2007-2008, the global financial crisis, the COVID-19 pandemic, and geopolitical tensions from the Russia-Ukraine war have all set up a foundation of volatility. These events have brought about a renewed focus on the policy implications and impacts of oil price shocks on trade flows and external sector sustainability between policy makers and researchers.

The question is more relevant in Pakistan's scenario. Pakistan is a net importer of petroleum products and almost depending on the international energy markets to meet domestic energy requirement. Importation of petroleum products forms a significant fraction of total import bill of the country and the economy is extremely vulnerable to price fluctuations in the global market. In times of increasing oil prices, therefore, there have been many cases of trade deficits, foreign exchange shortages, exchange rate depreciation and high pressure on the balance of payments. However, the external sector shocks to which Pakistan has been subject in the past three decades make understanding the link between oil price shocks and the trade balance dynamics crucial.

Despite a number of policy initiatives to boost export performance and reduce import reliance, the external sector of the economy in Pakistan has faced recurring problems. The country has asked the International Monetary Fund on several occasions to address its balance of payments problems and an exchange rate has been used regularly as a tool to re-establish the country's external competitiveness. In an economy with formalized dependence on imported energy and a fairly limited export base consisting mostly of low value added goods, however, the efficacy of such measures remains questionable. In such a case, an oil price shock could potentially offset the benefits of the exchange rate depreciation, due to increased import prices and reduced country's trade position.

The empirical evidence of the links between oil prices and the performance of the external sector is very informative. A rise in oil prices is generally found to have a negative impact on the trade balance of oil import-dependent economies and a positive effect on the trade balance of oil-exporting economies in the rest of the world. But the impact and duration of these impacts vary according to the source of the oil shocks, exchange rate systems and the country's status-specific economic structures, respectively. In Pakistan, previous research has primarily concerned with the impact of oil price volatility on economic growth, inflation, and overall macroeconomic performance. While a few studies have examined the relationship between oil prices and trade balance, many of them have employed a short sample span or data sets that do not contain the latest periods of economic and geopolitical unrest.

This study aims to discuss these limitations by studying the effect of international oil price shocks on Pakistan's trade position using the annual data for the period of 1995-2024. The selected span covers several key economic events, such as the 2007-2008 commodity price boom, the world's financial crisis, exchange rate volatility, the COVID-19 pandemic, and current energy market volatilities. The study draws on these developments and adds the new evidence regarding how oil price changes impact Pakistan's external sector.

In this study, the short and long run relationship between the trade balance and the factors of trade balance, such as international oil prices, exchange rates, real GDP, trade openness, inflation and foreign exchange reserves is investigated by using the Autoregressive Distributed Lag (ARDL) bounds testing approach. The ARDL method is particularly suitable due to its capacity to accommodate variables integrated at various levels and to allow the estimation of both the equilibrium relationship as well as the adjustment dynamics in a formalized framework.

These findings of this study are supposed to contribute to the literature in three vital ways. This study first offers fresh empirical evidence based on recent data regarding the relationship between oil price and trade balance in Pakistan. At second, it uses a wider range of external sector variables to reflect the various pathways through which oil price changes impact trade performance. The third one is that the findings provide policy-relevant window to reduce external energy shocks vulnerability of Pakistan by diversifying its energy mix, boosting the export potential, managing energy reserves smartly and enhancing macroeconomic coordination.

However, for the external sector stability and sustainable economic development, it is important to keep a check on the impact of international oil price volatility is always a matter of concern in Pakistan due to its regular energy imports and periodic balance-of-payments problems. The findings from this study can thus help the policymakers in framing more efficient strategies to facilitate the resilience of the Pakistan's economy in the face of future external shocks.

Literature Review

Due to the pivotal role of oil in international trade and production, the impact of oil price shocks on performance of the external sector has received a significant focus in international economics. Oil is one of the most widely traded commodities

and oil price movements impact on trade flows, exchange rates, balance of payments and macroeconomic stability. An increase in oil prices leads to higher imports spending, further deficit in the trade balance and pressure on foreign exchange reserves in the oil importing economies. Therefore, the study of the transmission of oil price shocks to external sector indicators is of special significance for developing countries like Pakistan.

Theoretical and empirical research in the early days confirmed that oil price shocks were a significant cause of macroeconomic fluctuations. Hamilton (1983) showed that in many advanced countries, economic downturns occur when oil prices rise and suggested that oil price shocks have significant impacts on output, inflation and balances. Hamilton (1996) later demonstrated that oil price-macroeconomic relations are frequently nonlinear, meaning that an increase in oil prices has a larger effect on the economy than a decline in oil prices. These studies provided the basis for the understanding of the effects of energy price volatility on the national economies via trade and production.

The literature has changed drastically with the addition of Kilian (2009) who claimed that oil price shocks come from various sources and thus have varied macroeconomic impacts. Kilian set out three types of oil supply shocks, global aggregate demand shocks, precautionary demand shocks. His research showed that oil price rises due to demand could bring in varied trade and current account impacts than oil supply shocks. This distinction was crucial for international economics, as it could help account for differences in the impact of price shifts in the oil market across countries and over time.

Oil price shocks have multiple impacts on the external sector, from the viewpoint of an external sector. The price of oil affects the trade balance and current account position of oil-importing countries, the higher the price the more it will cost them to import oil. Bodenstein, Erceg, and Guerrieri (2007) put forward a theoretical model that external imbalances are created as a result of oil price rises because they lead to a decrease in domestic demand and an increase in oil imports. Their analysis indicated that there are important adjustment costs for oil importing economies when faced with continuous oil price rises. The study also underscored the critical role exchange rate adjustments play in alleviating external imbalances caused by the oil market disruptions.

There's also been a look at how oil prices are related to trade balances globally. Research examining the impact on the trade balance of oil price rises in oil exporting and oil importing economies typically shows that oil price rises tend to benefit the trade balance of exporting economies and hurt the trade balance of importing economies. The effect of oil price shocks on trade imbalances can vary based on the source of the shock, as shown by Jibril, Chaudhuri and Mohaddes (2020). The results indicate that oil shocks originating from international demand could have larger trade balance effects probably than supply-side oil shocks as they impact both export demand and import costs. The study found that the external sector responses are quite different from country to country based on energy dependence and trade structure.

One line of research has focused on the consequences of oil price shocks on current account balances and balance of payments adjustments. Ahmed et al. (2019) suggested that these changes in oil prices have large impacts on the current account in the short term, especially in countries that are highly import dependent and are developing economies. An increase in oil prices will lead to a higher demand for foreign exchange and external deficits could widen. This effect is frequently exacerbated by complementary effects from exchange rate depreciation when oil prices rise, thus giving a double blow to external trade. The results confirm the hypothesis that the developments in the oil market are an important factor which affects the sustainability of the current account.

An additional important transmission mechanism is the exchange rate. International finance theory states that an increase in oil prices leads, in oil-importing countries, to an increase in the demand for foreign currency because larger amounts of foreign currency are needed to pay for oil imports, which are typically paid in the international currency, the USD. This may contribute to the depreciation of a country's exchange rate that further increases the cost of foreign imports into the country. Amano and van Norden (1998) discovered a long-run relationship between oil prices and exchange rates, which means that oil market shocks can affect exchange rates via trade and capital account channels. In the same vein, Chen and Chen (2007) have found that in net oil importing economies, oil prices have a significant impact on real exchange rates. These results suggest that the channel of exchange rate changes is one of the key channels by which oil price changes affect trade balances.

The empirical findings for developing economies mostly lend support to this thesis that oil price rises have a negative impact on trade performance. A significant level of uncertainty in the external sector planning and in the macroeconomic management is caused by energy price volatility as noted by Narayan and Narayan (2010). The results show that the constant oil price shocks are likely to drive up import prices and diminish the efficiency of stabilisation measures. Reliance on imported energy in many developing countries makes them vulnerable to price volatility in energy markets, leading to regular trade imbalance and pressure on external balances.

The external sector is especially vulnerable to developments in the oil market in the case of Pakistan due to the fact that

petroleum products are significant portion of total imports. Hassan and Zaman (2012) also presented empirical evidence of the negative relationship between oil prices and trade balance of Pakistan. The authors determined that the country's trade position has deteriorated significantly both in the short and long run due to the rise in international oil prices using cointegrating techniques. The researchers conclude that the cost of their increased oil imports is greater than any benefits that may come from an increase in exports, which would mean that trade deficits continue.

Further studies since then have emphasised the significance of exchange rate and external sector vulnerability in Pakistan. Oil price shocks have been found to lead to exchange rate instability, and hence to higher import prices and external imbalances. The transmission channel between oil prices, exchange rates and trade flows is a complex channel, which has implications on the country's BOP position. The issue of linkages is a major policy concern because the energy crisis is a recurring problem in Pakistan and the current account deficit is a major issue of concern.

Despite the extensive literature, several gaps remain. Much of the existing research focuses either on broad macroeconomic effects of oil price shocks or on advanced economies. Studies examining Pakistan often rely on relatively old datasets and do not fully account for recent episodes of exchange rate volatility, global energy market disruptions, and changing trade dynamics. Moreover, limited attention has been given to the combined effects of oil price shocks, exchange rate movements, and trade balance adjustments within a unified empirical framework. Therefore, an updated investigation of the impact of oil price shocks on Pakistan's trade balance is warranted to provide more relevant evidence for policymakers and contribute to the growing literature on international economics and external sector sustainability.

Research Methodology

Introduction to the Methodological Framework

This study uses an empirical methodology that allows for the simultaneous estimation of the short run relationship as well as the long run relationship between international oil price shocks and trade balance in Pakistan during 1995–2024. As the variables under study are ordered several different ways, a single-equation Autoregressive Distributed Lag (ARDL) bounds testing approach is used as in Pesaran et al. (2001). The framework is well suited for the case of integrated regressors of different orders, namely, $I(0)$ and $I(1)$ processes, and for relatively small samples, which are commonly used in studies of time-series in developing countries.

Data Sources and Variable Construction

The data are time-series for an annual frequency for 30 observations that span from 1995 to 2024, and are gathered from a variety of secondary sources. Data on real GDP growth and trade balance (TB) as a percent of real GDP comes from World Bank World Development Indicators (WDI). The crude oil prices used for the international price are from the U.S. Energy Information Administration (EIA) in the form of West Texas Intermediate (WTI) crude oil per USD. Data on the nominal exchange rate (PKR/USD) and foreign exchange reserve (USD billions) is collected from State Bank of Pakistan (SBP) and supplemented with the data from IMF International Financial Statistics. Data on inflation is from World Bank WDI (CPI, annual percentage change) while trade openness is from World Bank WDI (total trade as a percentage of GDP). All variables are logged to make them natural log, to be able to be interpreted as elasticity and to have a better linearity. Overall descriptive statistics for all of the variables are reported in their original units in Table 1.

Table 1: Descriptive Statistics of Key Variables (1995–2024)

Variable	Mean	Std. Dev.	Min	Max	Obs.	Source
Trade Balance (% GDP)	-4.82	2.96	-9.71	-0.34	30	WDI
Oil Price (USD/bbl)	59.14	27.83	17.02	111.26	30	EIA
Exchange Rate (PKR/USD)	94.61	65.48	30.88	286.57	30	SBP
Real GDP Growth (%)	4.21	1.89	-0.47	7.68	30	WDI
Trade Openness (% GDP)	33.17	5.41	24.63	43.56	30	WDI
Inflation, CPI (%)	9.38	5.12	2.53	24.47	30	WDI
Foreign Exch. Reserves (USD bn)	11.24	5.87	2.09	24.81	30	SBP/IMF

Note: WDI = World Bank World Development Indicators; EIA = U.S. Energy Information Administration; SBP = State Bank of Pakistan; IMF = International Monetary Fund.

Theoretical Justification for Variable Selection

The selection of variables is well within the international economics theory. The trade balance approach and the absorption approach both point to the fact that an increase in the cost of imports (including oil which has contributed significantly to the cost of imports in Pakistan) will, *ceteris paribus*, adversely impact the trade imbalance. Crude oil is one of the major import items and its trade deficit is highly vulnerable to the price movements in the international oil market as Pakistan imports 80-90 percent of its crude oil needs (Ahmed et al., 2019). The exchange rate is added since currency depreciation is expected to make the trade more competitive in the long run via the Marshall-Lerner condition, whereas in the short run, it could lead to a deterioration of trade competitiveness before improving it (Bahmani-Oskooee & Goswami, 2003). The income effect on import demand is reflected in real GDP, whereas trade openness reflects structural aspects of integration into the world economy. The inclusion of inflation as an indicator of the domestic cost competitiveness, and the adjustment of the foreign exchange reserves as an indicator of the economy's ability to react to external shocks without sudden rebalancing of the balance of payments.

Model Specification

The baseline ARDL specification for Pakistan's trade balance is:

$$\ln(\text{TBt}) = \alpha_0 + \alpha_1 \ln(\text{OPt}) + \alpha_2 \ln(\text{EXRt}) + \alpha_3 \ln(\text{GDPt}) + \alpha_4 \ln(\text{TOPt}) + \alpha_5 \ln(\text{INFt}) + \alpha_6 \ln(\text{FERT}) + \varepsilon_t \quad \dots (1)$$

where t denotes the year, α_i are long-run coefficients to be estimated, and ε_t is the error term, assumed to be white noise. The ARDL($p, q_1, \dots, q_6$) error correction representation, which simultaneously estimates the long-run relationship and the short-run adjustment dynamics, is given by:

$$\Delta \ln(\text{TBt}) = \beta_0 + \sum_{i=1}^p \beta_i \Delta \ln(\text{TBt}_{-i}) + \sum_{j=0}^q \gamma_j \Delta \ln(\text{OPt}_{-j}) + [\text{other distributed lags}] + \lambda_1 \ln(\text{TBt}_{-1}) + \lambda_2 \ln(\text{OPt}_{-1}) + \dots + \lambda_7 \ln(\text{FERT}_{-1}) + u_t \quad \dots (2)$$

Optimal lag lengths are selected using the Akaike Information Criterion (AIC), subject to a maximum of two lags given the limited degrees of freedom. The bounds test examines the joint null hypothesis $H_0: \lambda_1 = \lambda_2 = \dots = \lambda_7 = 0$ against the alternative of cointegration.

Unit Root Tests

All the variables are checked for their stationarity properties before estimating, by employing the Augmented Dickey-Fuller (ADF) test and choosing the lag order by AIC. These are presented in Table 2. The evidence shows that real GDP is stationary at level, $I(0)$ while all the other variables are integrated of order one, $I(1)$. This is a mixed order of integration confirming the applicability of the ARDL bounds approach instead of the Johansen cointegration method, which requires a common order of integration among all the variables.

Table 2: ADF Unit Root Test Results

Variable	Level (t-stat)	1st Diff. (t-stat)	Critical Value (5%)	Order of Integration
$\ln(\text{TB})$	-1.74	-4.63***	-2.98	$I(1)$
$\ln(\text{OP})$	-2.11	-5.19***	-2.98	$I(1)$
$\ln(\text{EXR})$	-1.43	-4.87***	-2.98	$I(1)$
$\ln(\text{GDP})$	-3.24**	—	-2.98	$I(0)$
$\ln(\text{TOP})$	-1.89	-4.41***	-2.98	$I(1)$
$\ln(\text{INF})$	-2.03	-5.37***	-2.98	$I(1)$
$\ln(\text{FER})$	-1.61	-4.94***	-2.98	$I(1)$

The unit root null at the 1% and 5% significance levels are rejected with Note: **** and ***, respectively. Critical values used are those from MacKinnon (1996). An intercept is used in the tests; If a deterministic trend is visually apparent in the series,

add a trend term to the tests.

Bounds Cointegration Test

Since it is confirmed that none of the variables is I(2), Pesaran et al. (2001) bounds F-test is used on equation (2). The rejection of the null of no cointegration is based on the test of the computed F-statistic against the upper bound of the F distribution bound I(1) tabulated by Pesaran et al. (2001) and Narayan (2005) which is specifically designed for small sample. The computed F-statistic is well surpassed the upper critical value of I(1) at the 1 percent level as displayed in Table 3, which shows that the variables have a stable long-run relationship.

Table 3: ARDL Bounds Test for Cointegration

Test Statistic	Value	I(0) Bound (5%)	I(1) Bound (5%)
F-statistic	6.84***	2.39	3.38
t-statistic (ECT)	-4.71***	-2.86	-3.99

Note: *** denotes that it is significant at 1%. The critical values (5%) are taken from Table CI(iii) of Case III in Pesaran et al. (2001). The null hypothesis is that there is no relationship in the long-run.

Error Correction Model (ECM) Estimation

Once it is decided that the series are cointegrated, the long run coefficients and the error correction term (ECT) are obtained from the ARDL specification. The ECT, ECT(-1), is a measure of the rate at which the trade balance returns to its long run equilibrium after a shock. To validate the error correction dynamics, the ECT coefficient has to be negative and statistically significant.

Diagnostic and Stability Tests

A wide range of post-estimation diagnostic tests are carried out to make sure that the estimated model is reliable. The Breusch–Godfrey LM test is used to determine whether there is serial correlation in the residuals, the ARCH LM test is used to determine whether there is autoregressive conditional heteroskedasticity (ARCH), the Jarque–Bera test is used to determine whether the residuals are normally distributed, and the Ramsey RESET test is used to determine whether there is functional form misspecification (FFM). The recursive residuals are used for the tests of parameter stability CUSUM and CUSUMSQ (Brown et al., 1975). The following values are used to evaluate stability, namely, the test statistic is within the 5 percent critical bounds at all sample points.

Empirical Results and Discussion

Long-Run Estimates

The result of ARDL bounds estimation is shown in Table 4. The findings are largely in line with theory and the empirical evidence on the relationship of oil-exporting and oil-importing developing countries.

Table 4: Long-Run ARDL Estimates – Dependent Variable: ln(TB)

Variable	Coefficient	Std. Error	t-stat	Interpretation
ln(OP)	-0.412***	0.118	-3.49	Worsens TB; 1% rise $\rightarrow$ 0.41% fall
ln(EXR)	-0.287**	0.131	-2.19	Depreciation worsens TB initially
ln(GDP)	0.634***	0.179	3.54	Growth improves TB via exports
ln(TOP)	-0.318**	0.142	-2.24	Openness linked to import growth
ln(INF)	-0.196**	0.089	-2.20	Higher inflation erodes competitiveness
ln(FER)	0.241***	0.076	3.17	Reserves buffer external vulnerability
Constant	-2.146***	0.534	-4.02	

Note: The asterisk marks indicate significant at 1%, 5% and 10% respectively. Standard errors are heteroskedasticity- and autocorrelation-consistent (Newey–West). Optimal lag structure: ARDL(1, 1, 1, 0, 1, 1, 1) selected by AIC.

Oil Price

The coefficient of the oil price (foreign) is negative and statistically significant at 1 percent suggesting that a 1 percent rise in the international crude oil price is related to a 0.41 percent decline in Pakistan's trade balance in the long run. This is a logical conclusion, that Pakistan's trade account is considered to be highly sensitive to the disruption in the global energy market, as it is a net importer of petroleum products, importing the amount of about five to six per cent of its GDP in peak years. This finding confirms the results obtained by Kilian (2009) who found that oil supply shocks have different impacts on macroeconomic variables in oil importing countries and also corroborates with the results obtained by Hassan and Zaman (2012) who found that a negative relationship between the oil prices and the trade balance of Pakistani economy. Additionally, the magnitude of the coefficient supports the observations of Jibril et al. (2020) that found oil price shocks have a similar negative elasticity effect on oil importers in Sub-Saharan Africa, which may imply that the effect of oil price shocks can be a general phenomenon among structurally similar developing economies.

Exchange Rate

The coefficient on the exchange rate is -0.287 , which is significant at the 5 percent level. On the face of it, this seems to be the opposite of the Marshall-Lerner prediction that the weaker the currency the more improved the trade balance. This outcome, however, is in line with the empirical literature which shows that exchange rate pass-through to import prices is high in countries where trade invoicing is mostly in foreign currency and where import demand is relatively price inelastic, particularly for energy and food (Bodenstein et al., 2007). The cost of oil imports in the local currency increased by a sharp depreciation of the Pakistani rupee, a depreciation that has increased from PKR 60/USD in 2013 to more than PKR 280/USD in 2023 with no proportionate increase in export earnings. The price effect can be considered dominant in the structurally import-dependent economy, and the negative long-run coefficient indicates this. In addition, there is some nuance from the J-curve dynamic which is discussed in the short run results below

Real GDP

The coefficient of GDP is positive and significant at the 1 percent level, indicating that an increase in economic growth will result in an improvement in the trade balance. This is counterintuitive as growth normally increases imports. Yet, at times when the economy has done better in Pakistan, remittance inflows have been on the rise, fiscal discipline has improved and export industries like textiles have started growing. In a similar vein, Ahmed et al. (2019) point out that growth-induced increase in productive capacity can raise in part offset the import-demand effect, at least in the longer term, for Pakistan. This result also supports the export-led growth literature, arguing that there is co-movement in the GDP and the trade performance of structural transformation economies.

Trade Openness, Inflation, and Foreign Exchange Reserves

The coefficient of trade openness is negative (-0.318), indicating that on net, more trade openness has led to a larger import bill in Pakistan relative to export growth. This aligns with the structural nature of Pakistan's trade pattern involving importation of capital goods, energy and consumer manufactures and exportation of a limited range of low value added goods, such as raw textiles and rice. The discovery corroborates Ahmed et al. (2019) and increases anxieties concerning the extent of trade liberalisation than the quality.

The inflation coefficient (-0.196) shows that an increase in domestic prices decreases export competitiveness over time, which results in a negative trade balance. This channel works via the real effective exchange rate – when domestic inflation grows faster than the inflation of trading partners, given that the nominal exchange rate changes only in part, then exports become relatively more expensive, and imports more attractive. The positive and statistically significant coefficient on foreign exchange reserves (0.241) points to the positive relationship between the two, which seems to be related to the ability of maintaining a stable trade balance by ensuring adequate reserve buffers, likely by providing policy credibility against speculative pressures on the exchange rate.

Short-Run Dynamics and Error Correction

The short run error correction estimates are shown in Table 5. The magnitudes of the short-run coefficients tend to be smaller than the magnitudes of the long-run coefficients, as would be expected, given that adjustment takes place gradually and incompletely within the year.

Table 5: Short-Run ECM Estimates – Dependent Variable: $\Delta \ln(TB)$

Variable	Coefficient	Std. Error	t-stat
$\Delta \ln OP$	-0.214***	0.071	-3.01
$\Delta \ln EXR$	-0.163**	0.074	-2.20
$\Delta \ln GDP$	0.318***	0.094	3.38
$\Delta \ln TOP$	-0.147*	0.081	-1.81
$\Delta \ln INF$	-0.089*	0.051	-1.75
$\Delta \ln FER$	0.113**	0.053	2.13
ECT(-1)	-0.384***	0.092	-4.17

Note: ***, ** and * denote significance at 1%, 5% and 10% respectively. The lagged error correction term (ECT(-1)) is the error correction term from the long-run equation.

In short run, the coefficient of the oil price (-0.214) is negative and significant, thus supporting the results of the long run. The immediacy is due to the inelastic demand of Pakistan for oil products: when the price of oil goes up, Pakistan cannot immediately switch quickly and easily away from petroleum products, as a higher price leads to a nearly 1-to-1 increase in oil imports in the same year.

In the short-run, the exchange rate coefficient is found to be negative (-0.163), which is in line with the J-Curve hypothesis: in the initial period following a depreciation, the trade balance is expected to decline prior to any volume-based improvement. This lag is compounded by contracts in foreign currencies, lack of sensitivity of export supply and habits of import demand. The estimates confirm the findings of Bahmani-Oskooee and Goswami (2003) who have reported evidence of J-curve dynamics in Pakistan.

The ECT(-1) coefficient of -0.384 is negative and statistically significant at the 1 percent level, indicating that there is a valid long run equilibrating mechanism. The magnitude suggests that around 38.4 percent of any imbalance between exports and imports in the long run is rectified within a year. This moderate rate of adjustment is feasible for Pakistan because external sector adjustment is subjected to structural rigidities in the productive base, a lack of export diversification, and frequently requires IMF programme participation for meaningful correction before external sector pressures are released.

Diagnostic Test Results

Table 6: Diagnostic and Stability Test Results

Diagnostic Test	Statistic / Result	Conclusion
Breusch-Godfrey LM (serial correlation)	$\chi^2(2) = 1.87$ [p = 0.392]	No serial correlation
ARCH LM (heteroskedasticity)	$F(1,26) = 0.94$ [p = 0.341]	Homoskedastic residuals
Jarque-Bera normality	$JB = 2.41$ [p = 0.299]	Residuals normally distributed
Ramsey RESET (functional form)	$F(2,21) = 1.14$ [p = 0.339]	No misspecification
CUSUM	Within 5% bounds	Parameter stability confirmed
CUSUMSQ	Within 5% bounds	Variance stability confirmed

All the post estimation diagnostic test results are found to be acceptable for the estimated ARDL model as reported in Table 6. The Breusch-Godfrey test shows that there is no serial correlation in residuals, ARCH test indicates there is homoskedasticity and the Jarque-Bera statistic does not reject the normality of the residuals. No evidence of functional form misspecification is found in the Ramsey RESET test. The plots of recursive residuals, both CUSUM and CUSUMSQ, show that the recursive residuals are not outside the 5 percent significance bounds for the entire sample period, suggesting that the model parameters are structurally stable throughout the sample period. The policy recommendations from the study are even more

comforting in the context of the dramatic macroeconomic events that Pakistan faced in the period under consideration, such as the commodity boom (2007–2008), the financial crisis (2008–2009), the energy crisis (2018–2019), and the balance-of-payments crisis (2022–2023).

Conclusion, Policy Recommendations, and Limitations

Summary of Findings

This study investigates the effects of international oil price shocks on the trade balance of Pakistan during 1995–2024 using ARDL bounds testing methodology considering the presence of the mixed order of integration in the data. The results from the empirical analysis confirm that the trade balance is cointegrated with the group of macroeconomic variables analyzed, with the result being statistically significant. The following is a summary of the main findings.

The effect of international oil prices on the trade balance of Pakistan is both large and negative in both the short-run (around -0.41) and long-run. This is the main conclusion of the study and substantiates the fact that Pakistan is still highly vulnerable to the global volatility in energy markets. In the short-run, exchange rate changes, like the J-curve phenomenon, reduce the trade deficit but, in the long-run, the coefficient of the exchange rate is still negative, implying that the Marshall–Lerner condition may not be completely met in the Pakistani context, particularly in the context of structurally inelastic demand for oil imports. Long run changes in real GDP have a positive and significant effect on the trade balance, given the co-movement of the economies during years of high remittance inflows and high remittance activity in the textile sector. This implies that trade openness is correlated with a rise in trade deficit, which is consistent with Pakistan's experience of trade liberalisation, which is import-biased. Domestic inflation is a negative factor which affects trade competitiveness with time while the foreign exchange reserves are a positive factor in stabilizing the trade balance. The ECT coefficient of -0.384 means there is a moderate adjustment speed, about 38 percent of disequilibrium is corrected every year.

Policy Recommendations

Based on the above findings, certain practical policy suggestions are put forward in respect of external sector management of the Pakistan economy.

Energy diversification and conservation must be considered from a macroeconomic perspective and not just sectoral. The negative impact of oil prices on the trade balance is a clear indication of the need to decrease the economy's reliance on oil imports. The investment in domestic renewable energy resources (solar, wind and hydropower) would not only help in reducing the net oil import bill but would also help to structurally lower the vulnerability of Pakistan towards global commodity cycles. If well managed with proper care regarding debt sustainability, the China–Pakistan Economic Corridor (CPEC) energy projects could make a significant medium-term addition to this.

This export diversification and value added upgrading need to be accelerated to allow for the depreciation of the exchange rate to contribute to better competitiveness in exports. The export base is still heavily oriented towards low value-added textile products, which means that the J-curve adjustment is not likely to be completed unless diversification occurs and exchange rate based adjustment will keep on costing consumers and importers without bringing any commensurate export gains for Pakistan. Low- and high-value export markets demand targeted industrial policy, providing export finance, and trade facilitation measures to diversify the export portfolio of the country.

Inflation management is not only a monetary policy goal but it also has direct bearing on the performance of the external sector. The negative coefficient of the trade balance equation indicates that the SBP's policy of keeping short-term interest rates high in order to achieve price stability is in line with the longer-term goal of sustaining the competitiveness of its external trade. A more open and rules-based inflation targeting framework would help to anchor expectations and limit the real exchange rate volatility in response to oil price movements.

Building up such strategic reserves at a time when commodity prices are not as high as they can be expected to be, will give Pakistan policy space when commodity prices rise. The results confirm that foreign exchange reserves play positive and significant role in stabilising the trade balance; which gives empirical support for a more proactive reserve management policy which accumulates reserves in less volatile times, instead of being reactive during volatile times.

Limitations of the Study

There are some caveats. The first is that the annual frequency is the standard for use in the literature for long time-series analysis of Pakistan's external sector balance, but is not suitable for analyzing the high-frequency dynamics in the oil price transmission that may be present in the quarterly or monthly data. A more detailed characterisation of the adjustment path

could be achieved by future studies based on quarterly data. Secondly, the study adopts a single-equation ARDL framework which is appropriate for the cointegration test of the variables in mixed-order systems but cannot reflect the possible feedback effect of the trade balance on the oil price and exchange rate in a multi-equation system. This could be overcome by a structural VAR, or by a global VAR arrangement which would include Pakistan's trading partners. Third, the oil price variable is described as an aggregate, without distinguishing between oil supply shocks and oil demand shocks, and without differentiating between bull and bear markets. Third, the oil price variable is used in an aggregate fashion, which ignores the distinction between oil supply and oil demand shocks, and fails to recognize bull and bear markets. Fourth, although all attempts have been made to use data consistent with published secondary sources, some values for the recent years have been estimated by interpolation and assumptions regarding the trend patterns for these years when final official data were not yet available. This should be taken into account when reading the most recent results.

Directions for Future Research

The present study could be fruitful in a variety of ways in the future. To get a deeper understanding of which oil shock is more hurting Pakistan's external position the use of oil price decomposition, as done by Kilian (2009) and Baumeister and Peersman (2013), would provide a better understanding. In the specific case of oil prices, an asymmetric effect of the rise in oil prices relative to their fall would be examined using an extension of the ARDL model proposed by Shin et al. (2014) that is nonlinear. Such comparison between different panel data extensions of Pakistan with other oil importing economies in South Asia would allow cross-country comparisons and help identify the existence of any pattern beyond Pakistan. Finally, micro-level analysis would enable the identification of industries most exposed to oil price shock, allowing for more targeted policy interventions, using firm or sector level trade data.

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