

“THE EFFECTS OF OIL PRICE FLUCTUATIONS ON PAKISTAN'S CURRENT ACCOUNT BALANCE: AN EMPIRICAL INVESTIGATION USING ARDL MODEL”

Dr. Syeda Anam Hassan^{*1}, Ms. Adan Hassan², Ms. Nazish Rafaz³, Ms. Zartasha Ishaq⁴,
Inayatul Haq⁵

^{*1}(Asst. Prof of Economics, Government Girls Degree College, Nawansher, Abbottabad. KPK, Pakistan.

^{2,3,4}(COMSATS University Islamabad, Abbottabad Campus).

⁵(SS Economics, GHSS.No.1 Abbottabad).

¹dranamhassan92@gmail.com

Corresponding Author: *

Dr. Syeda Anam Hassan

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ABSTRACT

Oil is a fundamental component of the energy source that highly affects the economic growth across the World. The level by which economies are distracted as a result of high charges depends on a stake of the cost of oil rates in national income. The purpose of the study is to explore the effect of oil rates, FDI, exchange rate, inflation and FDI on Balance of Payment by using ARDL model for the time period of 1990-2025 in Pakistan. The econometric results show that one dollar increase in exchange rate leads to increase the balance of payment by 112718786.95 dollars in short run while decreases -213015278.83 dollar in long-run. In case of FDI, one dollar increases in FDI decreases -2569828653.26dollars in the balance of payment in short run and-3296503106.09 dollars decreases in long run. The disturbance in the BoP shows that one dollar increase in oil prices decreases -55051701.86 dollars and -70618757.38-dollars balance of payment in short and long run respectively. While, one dollar increases in GDP decreases -49207450.99 dollars in balance of payment in short run. Finally, 1dollar increase in inflation decreases -334430380.90 dollar and -194729101.66 in the balance of payment in short run and long run respectively. ECM_(t-1) value -0.779* shows that model will converge to equilibrium at the rate of 77% in long run. Diagnostic results depict that there is no serial correlation neither heteroscedasticity in the model while Cusum and Cusum square shows the stability of model at 5% significant level. This study suggests that in order to maintain the current account balance Government should decrease its dependence on oil imports and energy demands should be fulfilled by means of Hydropower, coal energy, wind energy and solar energy. Therefore, recommending the movements of the economy towards the usage of renewable energy resources.

Keywords: Balance of Payment, Oil prices, Exchange rate, GDP, Inflation, FDI, and ARDL..

INTRODUCTION

Pakistan, being a developing economy, is heavily reliant on oil imports to meet its energy demands. Fluctuations in global oil prices can significantly impact the country's current account balance, which is a critical component of its overall

Economic health. The current account balance reflects the difference between Pakistan's exports and imports of goods and services, and changes in oil prices can influence this balance by affecting the country's import bill. Given the volatility of oil prices in recent years, understanding the effects of these fluctuations on Pakistan's current account

balance is crucial for policymakers and economists (Ahmad et al., 2025). This study provide insights into the dynamics of this relationship and informing strategies for managing the country's external sector.

Oil is a major source of obtaining energy which is the significant component of worldwide economic activities. Oil rates can distress the economies all over the world in various manners. A rise in oil rates will lead to raise the cost of production that causes the inflation in an economy in future and have a negative impression on the financial market. High oil prices have greatly affected the capital of a state that it relocates the income from oil importing to oil exporting nations via trade while fluctuations in trade balance cause the variation in an exchange rate. (Turhan et al., 2012).

Oil prices shock has been a critical issue globally. Especially the oil importing countries are more anxious about it and they are highly dependent on importing oil. Oil prices fluctuations affect the macroeconomic variables of developing countries such as; Pakistan via various ways. Most industries use oil as a primary input so as the oil prices increases the output of industries decreases. Increase oil prices transfer income from oil importing to exporting countries. Inflation has a direct relation to oil prices as the rise in oil charges cause a rise in inflation as more petroleum imported goods (Malik et al., 2017).

The upswing in oil rates has been a great issue during former three depressions. The all over a world economic depression have been experienced in last year's regarding high oil prices, such as the crises of 1973 and 1979 arises because of 1979 Iranian revolution. After 1973, oil crisis has been supplementary unbalanced than the cost of other goods. The rates of raw oil, refined fuel, and natural gas are more unbalanced than around 95%

of goods traded by local producers. Raw oil prices are presently more unstable than around 65% of other goods (Regnier, 2007). In 2005-06 the 32% of oil energy is consumed. Higher the oil prices will increase the inflation, leads to increasing the cost and low investment in oil importing countries. Energy area of a country has a positive relation to the economic growth of a state. Pakistan has more than the population of 150million and during last 3-4 years Pakistan increases its GDP and GDP increases 4.5% in 2005-06, along with an increase in GDP the demand for energy also increases (Hassan and Zaman, 2012). There are a lot of studies regarding oil charges and exchange rate. Pakistan faces devaluation in its exchange rate due to rise in oil rates and appreciation because of decline in oil rates, along with appreciation in Dollar. The influence of variations in oil rates shakes the exchange rate of Pakistan in three quarter and its returns to the pre-shock condition in fourth and frequently in the fifth quarter. Exchange rate dominated 10% by oil prices during fifth quarter (Ahmed and Qayyum, 2016).

From 2002-2004 the current account balance of Pakistan was positive. However, again it goes in to negative in 2004 to 2005 and 2006 to 2007 because of higher import machinery and bills of oil etc. (Ali, 2011). "The current deficit of Pakistan shows low export growth and, eventually export effectiveness problems. In November 2008, Pakistan's determined current account deficit does not show extremely productive economy, this problem was so thoughtful that Pakistan had to enter an International Monetary Fund program and borrow US 7.6 billion dollars to avoid nonpayment on its independent debt. From March-November 2008, 20 rupee had depreciated".

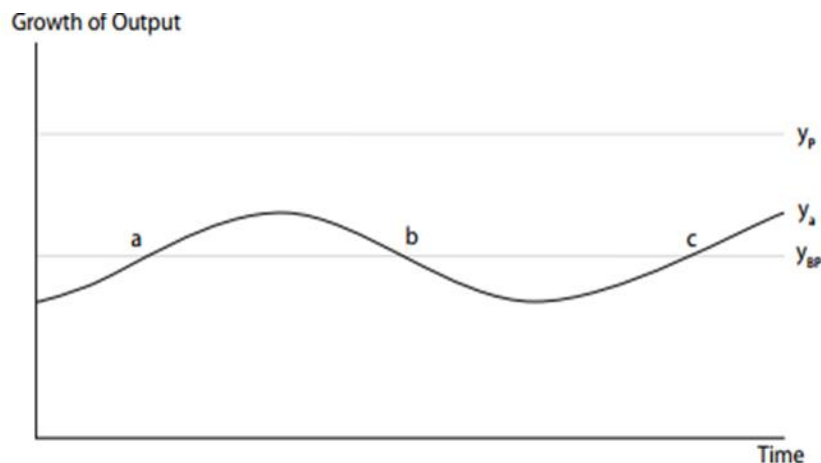


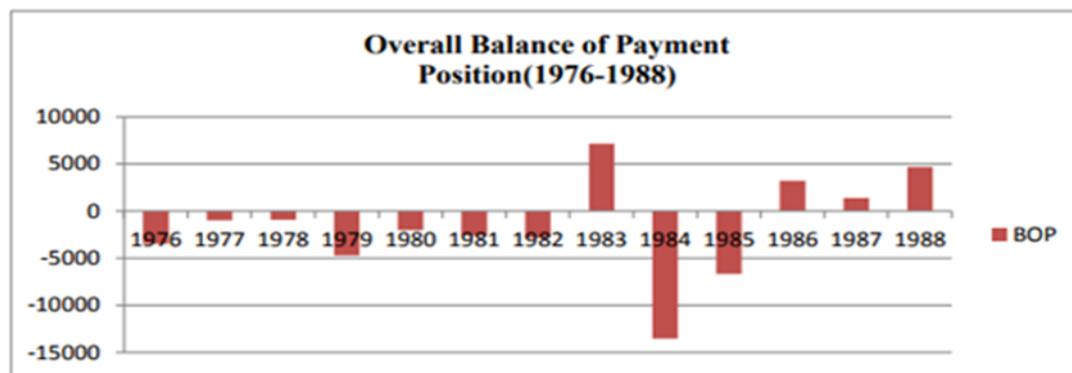
Figure 1:

Actual Growth, Balance-of-Payments Equilibrium Growth, and Growth of Productive Potential

While the growth of productive potential is not empirically a well-defined concept, it is likely that most less-developed countries could grow faster, given more foreign exchange. On one hand, if $y_A > y_{BP}$ the resulting current account deficit will necessitate y_A to decline until it equals y_{BP} . On the other hand, if $y_A < y_{BP}$, then the country will accumulate trade surpluses. Given the asymmetry in the adjustment process resulting from BoP

surpluses and deficits, there is no, or certainly less, pressure on the country to raise its growth rate until it reaches y_{BP} . A country can accumulate foreign exchange reserves almost indefinitely. This imparts a strong deflationary bias into the world economy (Felipe et al., 2009).

Several studies have worked on the balance of payments and economic growth. These studies show that stability in the trade balance is a key component in economic growth.



Sources: State Bank of Pakistan, International Financial Statistics, Pakistan Economic Survey.

Figure 2: Overall balance of payment position of Pakistan (Million Rupees)

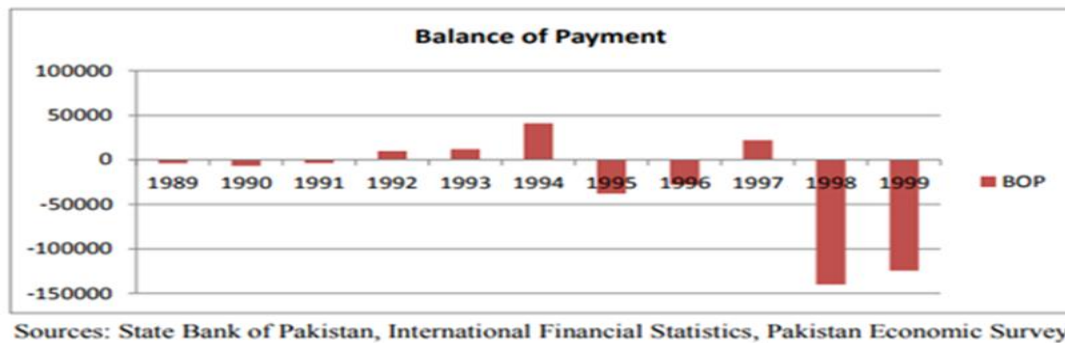


Figure 3: Overall Balance of Payment Position of Pakistan (Million Rs)

Figures 2 and 3 and 4, have depicted different periods. Every government adopted many different fiscal and monetary policies as far as its international transaction was concerned. But, every time, Pakistan balance of payment remained in deficit except these years 1947-48, 1950-51 and 1971-72. The deficit not only caused a domestic debt but also foreign debt. This total debt remained a big hurdle in the way of economic development. The overall balance of payments position deficit was highest in 2008 (Batool et al., 2015).

This research is conducted to investigate the impact of rise and fall in imports and exports (BOP) on GDP of Pakistan. Why are the Pakistan exports less than imports? The “exchange rate between two currencies is the rate at which one currency will be exchanged for another”. The exchange rate makes an impact on the revenues of the international market. The fluctuations in exchange rate also affect the investment of foreign investors. In case of Pakistan, the value of exchange rate is 100 rupees to 1 dollar. It means that to buy worth of \$1, it has to pay Rs100 and vice versa. Exchange rate shows the influence of lowering the rate of the cost of imports and curb output by discouraging exports when the exchange rate appreciates. The appropriate response in such circumstance lowers interest rates to stimulate the economy unless the inflation rate is too high to begin with (Ahmed et al., 2014). Pakistan has also taken initiatives to attract foreign investors to invest here, during the last decade. For these initiatives reforms in the macroeconomic environment is essentials. From 2005 to 2006 the foreign direct investment inflows in Pakistan are more than \$3billion in the first ten months of the year, which is the highest figure of the history of Pakistan. The export promotion in developing East

Asia, it is hard to ignore the role of Foreign Direct Investment. FDI also depends on the political system of the country (Bilawal et al., 2014).

Inflation that volatile in nature is inevitable during the process of a country development. Historically inflation due to imported oil shocks the economy and increase the inflation, Malaysia’s domestic inflation has reached a double-digit in 1947 by 17.3%, 9.7% in 1981 and 8.5% in 2008 (Azam et al., 2017). Oil prices have not only effect on the economic process, but it also make changes in the economic development of a country. Oil prices affect the economy, adversely and confidentially to the economy. A lot of controversies are there among policymakers and researchers regarding the unstable prices of oil. (Akpan, 2009), (Aliyu, 2009) and (Olomola, 2006) said that increases economic growth but on the other hand researchers like (Darby, 1982) and (Cerralo, 2005), according to them unstable oil prices inhibit economic growth, but it is experienced that oil importing nations with rising oil rates lead to increase the national income of exporting countries (Jawad and Naizi, years). After several bouts of high inflation in the 1970s, in combination with low growth and high unemployment, many policymakers tended to believe that keeping inflation at a low level is a prerequisite for sustained high economic growth (Uddin et al., 2017).

FDI is invented from the concept of a company redirection a portion of its activities to a chosen foreign country. FDI has created a great impact on the development of an economy it increases the productivity of all firms in a country not only those which gets foreign investment (Obonoyo and Tibbs, 2017). In developing countries like Pakistan, it is difficult to maintain long- run economic growth. Many factors which affect the economic growth i.e. internal sources like saving and human

capital are considered as an important component in economic growth while external sources are foreign remittances, foreign direct investment and import-export (Tahir et al., 2015). After registering surpluses in the last five months, Pakistan's current account posted a deficit of \$420 million in January 2025, a significant increase of 4% when compared with the deficit of \$404 million (Ndayiragije et al., (2025).

1.1 Significance of the study

Pakistan is currently covering a large trade balance discrepancy, which has given rise to many questions on the potential of the country as well as the causes of this imbalance. The balance of payments as one of the founding objectives of macroeconomic policy as International finance supports organizations such as the International Monetary Fund and World Bank have been giving a great deal of attention to constant trade balance situations in Pakistan. The study aims to investigate the impact of oil prices on Pakistan's trade balance, considering other key macroeconomic variables like Foreign Direct Investment (FDI), exchange rate, Gross Domestic Product (GDP), and inflation. The significance of this study lies in its potential to inform policymakers about the factors contributing to Pakistan's trade balance discrepancy, enabling them to make informed decisions to address trade imbalances and promote economic stability. As an oil-importing country, Pakistan is vulnerable to international oil price fluctuations, making it essential to understand the relationship between oil prices and trade balance. The study's findings can guide policymakers in mitigating the adverse effects of oil price shocks and promoting sustainable economic growth. By examining the period from 1990 to 2025, the study aims to provide valuable insights into the dynamics of Pakistan's trade balance and inform strategies for achieving a more stable and favourable trade position.

1.2 Objective of the study

Primary Objective: To empirically explore the impact of oil prices, GDP, exchange rate, inflation, and FDI on the balance of payments in Pakistan during 1990-2025.

Secondary Objectives:

- To examine the relationship between oil prices and Pakistan's trade balance.

- To assess the effects of macroeconomic variables (GDP, exchange rate, inflation, FDI) on the balance of payments.
- To provide insights for policymakers to address trade imbalances and promote economic stability.
- To identify potential strategies for mitigating the adverse effects of oil price shocks on Pakistan's economy.

2. Literature Review

In current scenario of Pakistan, fluctuations in oil rates has been a crucial issue which affect the economy. Numerous researcher explore how variation in OP effects the economy and current account balance. Hassan and Zaman,(2012) empirically studied the effect of rising oil rates on trade balance of Pakistan by using ARDL for the time period of 1975–2010. The analysis concluded that there exists a negative relationship among oil rates, exchange rate and balance of payment. The outcomes of Granger causality show that there is a bidirectional interconnection between oil rates and exchange rate, which concludes that it has to participate in substitute energy ventures to decrease its dependency on oil imports. Bal and Rath ,(2015) empirically investigated the direct relation between exchange rate and oil rates by using the Hiemstra and Jones (1994). The analysis indicates a significant bi-directional nonlinear causation between exchange rate and oil rates in India. The result indicates that the nonlinearity of oil prices stimuli the exchange rate regardless of the exchange rate policies. Piccolo et al., (2017) empirically investigated the impact of prices of oil on the global market from 1960 to 2011, by using Markov Chain methodology. This shows that throughout this time the detachment of labour and trade outline is strongly related to the oil rates around the globe. The result shows that there is a strong negative correlation (-0.85) between the share of cyclic value and oil prices. The analysis depicts, this correlation is not dependent on trade balance and also on the supposed value of trade, but it is related to the system of Global Value Chains (GVCs). This shows that transportation has a key role in determining GVCs, showing the strong, long-lasting influence on energy expenses. The association between oil prices and other macro determinants that effect the trade balance has been examined in various literature by variant researchers. i.e., Calderon ,(2002) empirically

analysed the linkage between current account deficits and key economic variables i.e Income, Current Account, and saving for 44 developing countries during 1966-1995 by using GMM system estimations. The result shows that domestic output growth rate has a direct and significant impact on the trade balance deficit. The final conclusion shows that nations with per capita GDP are closer to the developed countries tend to run lower trade balance deficits. [Gohar et al.,\(2009\)](#) empirically investigated the effect of external debt on the economic growth of lower-income countries for the time period of 1990 -2008 by using least square multiple regression model. The result depicts that external debt puts a negative influence on the economic growth of lower income nations in the presence of FDI and adjusted savings, affecting many macroeconomic factors. The study suggested that low-income countries must avail the option of debt forgiveness as it may reduce the debt levels due to them to pay and may give a chance to flourish. [Anoka,\(2014\)](#) empirically studied the balance of payments constrained growth in Nigeria. This study based on the theoretical underpinnings of the Original and Expanded Thirlwall's model derived from the Harrods Foreign Trade Multiplier. In this study, the OLS model states that Growth in real income depends on export, exchange rate, and net foreign capital inflows and terms of trade. The result of OLS suggested that Nigeria has to increase export by promoting the production of more attractive goods and services beyond oil and raw materials. Moreover, the Nigerian government should encourage the consumption of locally produced goods in response to increase income; this will certainly reduce imports and increase economic growth. [Bagnai , \(2015\)](#) empirically studied the association between trade balance and economic growth by on a BOP constrained growth methodology during 1985-2010 in Vietnam. The result infers that the high-income elasticities of exports enable growth in the advanced countries to have a multiplier effect on the Vietnamese economy. However, this effect is hindered by a high "desire" for imports coming from Asia. The results show that Vietnam grew less than the rate predicted during the entire period considered. This study suggested that the country will need to reconcile its financing needs with a prudent reliance on foreign saving.

Pakistan faces a execrate crises in its exchange rate, which badly affected the stock market and growth rate of Pakistan as well as boost up the inflation rate in an economy. This gives an attention to the economist to determine their impact on each other as well as on BoP. [Palwishah et al., \(2014\)](#) empirically studied the relation of the balance of payment and exchange rate in case of Pakistan economy during the seven-year time from 2007 to 2013. The reason behind this study is to get the association between the balance of payment and exchange rate. The result of ARDL shows the positive and significant relation. The analysis concluded that the stability of exchange rate improves the balance of payment in the economy. [Aleemi et al., \(2016\)](#) empirically studied the function of interest rate, exchange rate and gold prices in opposition to inflation in short run and long run in case of Pakistan. Johansen co-integration and VECM applied for the time period of 1975 to 2013. the result shows that in long run, inflation is positively related to interest rate and gold prices while in short run, inflation is negatively linked with the exchange rate. This shows that increase in rupee will result in depreciation in inflation and decrease in value of rupee will increase inflation. [Ahmad et al., \(2017\)](#) determined the effect of exchange rate on trade balance in case of Pakistan economy from January 2007 to October 2013 by using Granger causality and ARDL and a study concluded that there exists a substantial and positive relationship between exchange rate and trade balance, study also suggest that constancy of exchange rates can produce a positive circumstance by promising the investment, and this can improve trade balance

[Filho \(2006\)](#) examined the relationship between the BoP and inflation by using a canonical BoP constraint model. The study shows how inflation target can affect the growth rate in long run. The analysis concluded that the short run inflation implies changes in real exchange rate, while also changes the BoP constraint. [Yelwa et al., \(2015\)](#) investigated the association between economic growth and inflation in case of Nigeria for the time period of 1987 to 2012 by applying ordinary least square method. Results confirm that in the long run inflation has an inverse effect on growth. This study also suggested that the government should improve macroeconomic policy instruments to achieve an environment that will enhance domestic output. [Nardos and Beyene, \(2015\)](#)

investigated the relationship between Inflation and Balance of Payment from 1976 -2011 by Cointegrated VAR approach. The aim of the study is to determine the effectiveness of demand management policies in stabilizing the macroeconomic environment to Ethiopian economy. Results show that Balance of payment surplus leads to inflationary pressures in the economy while inflation booming weakens the country's external balance. Obaima and James (2017) studied the relationship between money supply and inflation during 1981 to 2015 by using AIC methodology in the Nigerian economy. The result shows that the money supply has a significant impact on inflation. A Government should increase the money supply as a means of targeting inflation encouraging the investment, and this can improve the trade balance. Aboubacar et al., (2017) empirically investigated the effect of inflation on trade and current account balance of WAEMU from 1980 to 2013 by using VAR method. The analysis found a significant and positive effect on the current account balance.

The biggest problem of the developing nation is the limited investment within a country. They highly depend on Foreign Investment and policy makers makes the policies which attracts the foreign investment inflow in a country. Lily et al., (2014) empirically studied the impact on foreign direct investment by the fluctuations in exchange rate, by using yearly figures on ASEAN economies, i.e. Thailand, the Philippines, Malaysia, and Singapore. The result of ARDL shows that there exists a long run co-integration between foreign direct investment and exchange rate. The negative coefficient telling that increase in Malaysian, Philippines and Singapore currency shows the positive effect on foreign direct investment. This analysis concluded that in case of Philippines and Singapore the bidirectional causality exists between foreign direct investment and exchange rate. Sultan et al., (2017) investigated the influence of exchange rate volatility, GDP, trade openness and current account balance on FDI in Pakistan for the period of 1981 to 2015 by using ARDL methodology. The result shows that exchange rate and BoP have a negative relation with FDI in the

long and short run. The empirical result of the study suggested that the government should implement that type of policies which promote stability of exchange rate and reduce its volatility and attract more FDI.

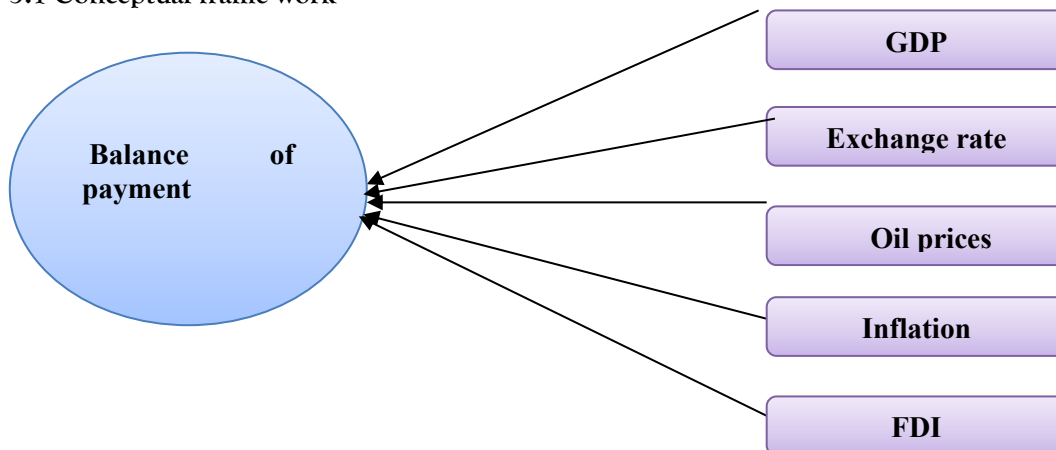
Recent studies have explored the relationships between macroeconomic variables and balance of payments in Pakistan. Research suggests that international oil prices significantly impact Pakistan's trade balance, as the country is an oil importer (Khan & Ahmed, 2019). Studies indicate that exchange rate fluctuations affect Pakistan's balance of payments, with depreciation potentially improving trade balance (Haque & Qayyum, 2018). GDP growth has been linked to improvements in Pakistan's balance of payments, driven by increased exports (Ahmed & Qasim, 2020). Inflation has been found to negatively impact Pakistan's balance of payments, as high inflation erodes competitiveness (Khan & Malik, 2022). FDI inflows have contributed positively to Pakistan's balance of payments, enhancing foreign exchange reserves (Shah & Khan, 2021). Pakistan's balance of payments has faced challenges due to global economic uncertainty and domestic macroeconomic imbalances (IMF, 2022). Studies suggest that structural reforms and policy adjustments are needed to improve Pakistan's trade balance and overall balance of payments (World Bank, 2023).

By reviewing an assortment of literatures on the effect of oil prices and different macro variables on balance of payment. This study makes the analysis on fluctuations in the balance of payment causing by oil prices with other key factors i.e. exchange rate, inflation, FDI and GDP in case of Pakistan during 1990 to 2025 by using ARDL methodology.

3. Data Source and Methodology

The data has been collected from World Development indicator (WDI, 2025), for the time period 1990 - 2025. The dependent variable is balance of payment (% of GDP) and Independent variables are: Oil prices (US\$), GDP (annual %), Exchange rate (2010 = 100), Inflation (annual %), FDI (% of GDP).

3.1 Conceptual frame work



Self-Extract

The conceptual framework reveals a complex relationship between macroeconomic variables and Pakistan's balance of payments. Fluctuations in international oil prices significantly affect Pakistan's balance of payments, given its oil-importing status. A decline in oil prices positively impacts the balance of payments, appreciating the Rupee and increasing foreign reserves. Conversely, rising oil prices increase production costs, contributing to inflationary pressures. To combat inflation, the State Bank may raise interest rates, reducing investment and output,

ultimately leading to a balance of payments deficit. The interplay between these variables is multifaceted. Rising oil prices increase production costs, adversely affecting GDP. Exchange rate fluctuations impact the balance of payments, with real exchange rate changes influencing trade competitiveness. Oil price increases depreciate the currency of oil-importing countries like Pakistan, while benefiting oil-exporting economies through currency appreciation. Exchange rate volatility affects FDI inflows, with depreciation attracting foreign investors and appreciation deterring them. These variables collectively influence Pakistan's balance of payments, highlighting the need for policymakers to consider their interconnectedness when addressing trade imbalances and promoting economic stability.

3.2 Hypotheses of the Study

The hypotheses of this study are:

- H₁: There exists a negative relation between oil prices to balance of payment.
- H₂: There exists a negative relationship between FDI to balance of payment.
- H₃: There exists a negative relationship between GDP to balance of payment.
- H₄: There exists a negative relationship between exchange rate to balance of payment.
- H₅: There exists a negative relation relationship between inflation to balance of payment.

4.

Methodology and Interpretation

4.1 Table 1 Descriptive Statistics

	BOP	FDI	GDP	INF	OP	ER
Mean	-3.100	1.144	4.197	8.516	59.250	106.651
Maximum	3.850	3.668	7.705	20.286	128.000	125.591
Minimum	-1.601	0.382	1.014	2.539	16.440	93.489
Skewness	-1.176	1.868	0.194	0.593	0.655	0.254
Kurtosis	5.456	5.490	2.472	3.426	1.915	1.830
Jarque-Bera	13.498	23.519	0.501	1.854	3.381	1.897

Note: BOP indicates balance of payment, FDI indicates foreign direct investment, INF indicates inflation, Op indicates oil prices and ER indicates exchange rate.

According to Table 1 Mean is the usual average. Mean of Balance of payment is (-3.100), FDI (1.144), GDP (4.197), inflation (8.516), oil prices (59.250) and exchange rate (106.651). Maximum means highest limit or highest value therefore, maximum of Balance of payment is (3.850), FDI (3.668), GDP (7.705), inflation (20.286), oil prices (128.00) and exchange rate (125.591). Minimum means lowest limit, the minimum of Balance of payment is (-1.601), FDI (0.382), GDP (1.014), inflation (2.539), oil prices (16.440) and exchange rate (93.489). The distribution of the data whether left or right along a curve is called Skewness balance of payment (-1.176) is negatively skewed while FDI (1.868), GDP (0.194), inflation (0.593),

oil prices (0.655) and exchange rate (0.254) are positively skewed. Kurtosis is the measure of the tails of frequency distribution when compared with normal distribution kurtosis of balance of payment is (5.456) and FDI (5.490) are leptokurtic and Inflation (3.426) is Mesokurtic while oil prices (1.915) and exchange rate (1.830) and GDP (2.472) are platykurtic. Jarque- Bera shows the goodness of fit of the model and the values are balance of payment (13.498), FDI (23.519), GDP (0.501), Inflation (1.854), oil prices (3.381) and Exchange rate (1.897).

4.2 Correlation Matrix

Table 2 Correlation Analysis

	BoP	FDI	GDP	INF	OP	ER
BoP	1.000000	-	-	-	-	-
FDI	-0.632486	1.000000	-	-	-	-
GDP	-0.058899	0.102019	1.000000	-	-	-
INF	-0.449067	0.346372	-0.293383	1.000000	-	-
OP	-0.547613	0.085791	0.122569	-0.041003	1.000000	-
ER	-0.160095	-0.386768	0.141689	-0.111384	0.167517	1.000000

Table 2 shows Balance of payment has a weak negative relation to FDI (-0.63), Inflation (-0.44), GDP (-0.05), Oil prices (-0.54) and exchange rate (-0.16). FDI (-0.63) has a strong positive relation with balance of payment (1.00) and weak positive relation with GDP (0.10), inflation (0.34) and oil prices (0.08) and also have weak negative relation with exchange rate (-0.38).

GDP has strong positive relation with BoP, while weak negative relation with FDI (-0.63) and inflation (-0.29) and weak positive relation with oil prices (0.12) and exchange rate (0.141). Inflation has strong positive relation with balance of payment and negative relation with FDI (-0.63),

GDP (-0.05), Oil prices (-0.04) and exchange rate (-0.11).

Oil prices has strong positive relation with balance of payment and weak positive relation with exchange rate (0.16) while negative relation with FDI (-0.63), GDP (-0.05), inflation (-0.44). Exchange rate has strong positive relation with balance of payment and negative relation with FDI (-0.63), GDP (-0.05), inflation (-0.44) and oil prices (-0.54).

4.3 ADF-Unit root test

A test of stationarity (or non-stationarity) that has developed extensively prevalent over the past

several years is the unit root method. The starting point is the unit root (stochastic) process,

$$Y_t = \rho Y_{t-1} + u_t - 1 \leq \rho \leq 1 \dots \dots \dots (1)$$

where u_t is a white noise error term. If $\rho = 1$, that is, in the case of the unit root, it converts a random walk model without drift, which we know is a non-stationary stochastic procedure. For theoretical details, we manipulate (1) as follows: Subtract ΔY_{t-1}

from both sides of (1) to obtain:

$$\Delta Y_t - \Delta Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + u_t \dots \dots \dots (2)$$

$$= (\rho - 1)Y_{t-1} + u_t$$

which can be instead written as:

$$\Delta Y_t = \delta Y_{t-1} + u_t$$

(2)

where $\delta = (\rho - 1)$ and, as typical, is the first-difference operator. In practice, therefore, in its place of estimating (1), we assess (2) and test the (null) hypothesis that $\delta = 0$. If $\delta = 0$, then $\rho = 1$, that is we have a unit root, connotation the time series under concern is non-stationary.

Table 3 Unit Root Test

Variables	Level		1 st difference		Decision
	Constant	Prob.	Constant	Prob.	
BoP	-1.944	0.308	-4.996	0.000	I(1)
FDI	-2.812	0.070	-3.326	0.023	I(0)
GDP	-3.788	0.009	-6.135	0.000	I(0)
OP	0.147	0.963	-6.307	0.000	I(1)
ER	-0.697	0.831	-3.840	0.007	I(1)
INF	-2.214	0.206	-6.460	0.000	I(1)

Table 3 depicts that in ADF unit root test data is significant at level and 1st difference. On the basis of the mix results of ADF test, the ARDL (autoregressive distribution Lag) model is applied to this investigation.

4.4 VAR Lag Order Selection Criteria

Bounds testing approach (Pesaran et al., 2001) is taken up to check the existence of short and long-run relationships between the specific considered variables in context of Pakistan. Econometric theory designate a set of variables is co-integrated if there is a linear combination among them without stochastic trend. In this case, a long-run relationship subsists between these variables. However, this implication is only valid if the obligation of the same order of integration has been met. Assume an explanatory variable, which is stationary at level is regressed with another variable, which is non-stationary at level but is first-difference stationary, then this will capitulate a spurious regression and thereby give a deceptive and erratic conclusion.

The use of the bounds technique is based on three validations. First, Pesaran et al. (2001) advocated the use of the ARDL model for the estimation of

level relationships because the model suggests that once the order of the ARDL has been recognized, the relationship can be estimated by OLS. Second, the bounds test allows a mixture of I(1) and I(0) variables as regressor, that is, the order of integration of appropriate variables may not necessarily be the same. Therefore, the ARDL technique has the advantage of not requiring a specific identification of the order of the underlying data. Third, this technique is suitable for small or finite sample size (Pesaran et al., 2001). Following Pesaran et al. (2001), we assemble the vector autoregression (VAR) of order p , denoted VAR (p), for the following growth function:

$$Z_t = \mu + \sum_{i=1}^p \beta_i z_{t-i} + \varepsilon_t \quad (1)$$

Where z^t is the vector of both x^t and y^t , where y^t is the dependent variable balance of Payment, (BoP), x_t is the vector matrix which represents a set of explanatory variables i.e., oil prices, Exchange rate, GDP, FDI, Inflation and t is a time or trend variable. According to Pesaran et al.

(2001), y_t must be I(1) variable, but the regressor x_t can be either I(0) or I(1). We further developed a vector error correction model (VECM) as follows:

$$\Delta z_t = \mu + \alpha t + \lambda z_{t-1} + \sum_{i=1}^{p-1} \gamma_t \Delta y_{t-i} + \sum_{i=1}^{p-1} \gamma_t \Delta x_{t-i} + \epsilon_t \quad (2)$$

where Δ is the first-difference operator. The long-run multiplier matrix λ as:

$$\lambda = \begin{bmatrix} \lambda_{yy} & \lambda_{yx} \\ \lambda_{xy} & \lambda_{xx} \end{bmatrix}$$

The diagonal elements of the matrix are unrestricted, so the selected series can be either I(0) or I(1). If $\lambda_{yy} = 0$, then Y is I (1). In contrast, if $\lambda_{yy} < 0$, then Y is I (0).

The VECM procedures described above are imperative in the testing of at most one cointegrating vector between dependent variable y_t and a set of regressor x_t .

Carbon emissions tends to be influenced and explained by its past values. The structural lags are established by using minimum Akaike's information criteria (AIC). After regression of equation, the Wald test (F-statistic) was computed to differentiate the long-run relationship between the concerned variables. The Wald test can be carry out by imposing restrictions on the estimated long-run coefficients. The null and alternative hypotheses are as follows:

$H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ (No long-run relationship)

Against the alternative hypothesis

$H_A : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$ (A long-run relationship exists)

The computed F-statistic value will be evaluated with the critical values tabulated in Table CI (iii) of Pesaran et al. (2001). According to these authors, the lower bound critical values assumed that the

explanatory variables x_t are integrated of order zero, or I(0), while the upper bound critical values

assumed that x_t are integrated of order one, or I(1). Therefore, if the computed F-statistic is smaller than the lower bound value, then the null hypothesis is not rejected and we conclude that there is no long-run relationship between Balance of Payment and its determinants. Conversely, if the computed F-statistic is greater than the upper bound value, then Balance of Payment and its determinants share a long-run level relationship. On the other hand, if the computed F-statistic falls between the lower and upper bound values, then the results are inconclusive.

The appropriate lag order for the VECM is determined by Akaike's information criterion (AIC) because it has superior properties in small sample (Lutkepohl, 1991; Liew, 2004). Ultimately, the short run Granger causality test is carried out by computing x2-statistics on the lagged explanatory variables while the t-significance of

ECT^{t-1} represents the long run causality direction.

Table 4 AIC (Akaike information criterion)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-966.2488	NA	1.22e	74.78837	75.07870	74.87198
1	-851.5210	167.6791*	3.10	68.73239	70.76470*	69.31762
2	-807.5813	43.93970	2.80*	68.12164*	71.89593	69.20850*

* indicates lag order selected by the criterion

In table 4 the AIC (Akaike information criterion) shows the lag length at 2, while SC (Schwarz information criterion) shows at 1.

4.5 Table 5: ARDL Bounds Test

t-stats	Value	k
F-stats	6.342	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35

5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Null Hypothesis: No long-run relationships exist.
In above table 5 the F-statistics is more than the formulated value of upper bound, therefore

rejecting the null hypothesis and indicating that there exist long run relationship.

4.6 Short and Long Run Coefficient

Table 6: Short and Long-run Coefficients

Variables	Short Run Coefficients		Long Run Coefficients	
	Coefficient	t-stats	Coefficient	t-stats
D(ER)	112718786.95*	1.424	-213015278.83*	-4.905
D(FDI)	-2569828653.26*	-5.581	-3296503106.09*	-6.526
D(GDP)	-49207450.99*	-2.935	-63121918.59	-0.288
D(INF)	-334430380.90*	-3.533	-194729101.66***	-1.874
D(OP)	-55051701.86*	-5.545	-70618757.38*	-6.096
ECM	-0.779562*	-6.468047	Durbin-Watson stat	1.92
Constant (long run)	29243320804.08*	5.881832	F-statistic: Prob(F-statistic)):	30.204 (0.000)
R-squared	0.928		Adjusted R-squared	0.896

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*Note : *, **, *** shows the significant level at 1%, 5% and 10% respectively.*

$$\text{BoP} = \beta_0 + \beta_1 \text{ER} + \beta_2 \text{FDI} + \beta_3 \text{GDP} + \beta_4 \text{INF} + \beta_5 \text{OP} \dots (1)$$

β_0 = intercept

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = are the slope of exchange rate, foreign direct investment, gross domestic product,

Inflation and oil prices respectively.

Table 6 depicts that in short run ,1% increase in exchange rate causes \$112718786.94 increases in BoP and in long run 1% increase in exchange rate \$-213015278.83 decreases the balance of payment. In short run, the exchange rate has a positive and significant relation with BoP and negative relation in long-run. As the exchange rate increases, the value of the currency falls into depreciation, this makes imports costly and that causes a discrepancy in the balance of payment and the result is consistent with Ahmed et al., (2014). In both short and long run, 1% increase in FDI causes \$-2569828653.26 and \$-3296503106.09

respectively. Trade liberalization attracts more foreign investors to invest and it has an adverse effect on trade balance.

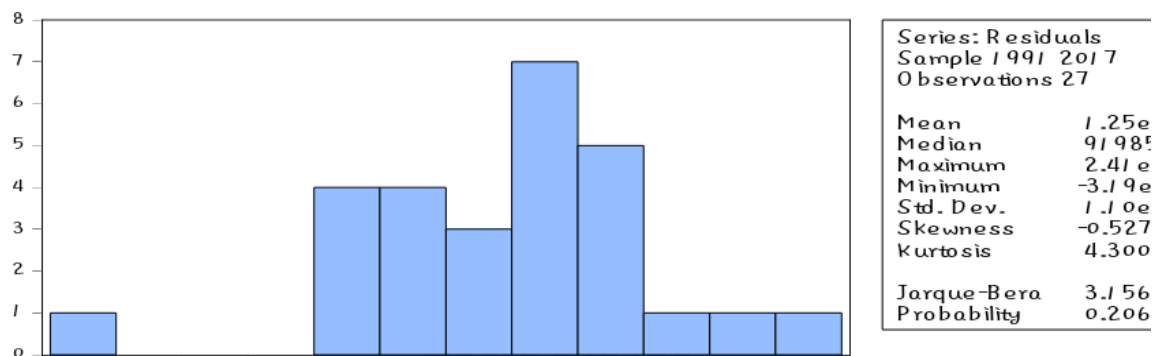
Because when the oil rates increase at international market it creates devaluation in currency and thus, the import of FDI becomes expensive creating deficit in balance of payment, and the results are consistent the Sultan et al., (2017). 1% increase in GDP affect \$-49207450.99 decrease in balance of payment in short run while it is insignificant in long run. GDP has an adverse impact on trade balance of payment when the prices upsurge the general cost of production in an economy increases, which decreases the production and reduces the national income of the nation and lessens the exports and vice versa and the result is consistent with Batool et al., (2015). Inflation has a negative relation to balance of payment in both short and long run Increase in money supply creates an inflation in an economy as the inflation increases the cost of imports also increases and the balance of payment become negative as 1% increase in inflation in both short and long run,

decreases balance of payment by \$-334430380.90 and \$-70618757.38 respectively and the result is consistent with Yelwa et al., (2015). While oil prices have a negative relation to the balance of payment that 1% increase in oil rates causes \$-55051701.86 and \$-70618757.38 in short and long-run respectively. As Pakistan is oil importing country, the increase in oil rates will lead to raising the imports of petroleum and the goods related to petroleum which increases the import receipts that causes a deficit in the balance of payment and the result is consistent with Piccolo et al., (2017). ECM value (-0.779*) is negative and significant this

shows that model will converge to equilibrium at the rate of 77% in long run. Durbin Watson 1.92 approximately to 2 illustrates that there is no autocorrelation problem in the model. R-square 0.928 depicts 92% total variation in dependent variable due to explanatory variables that 1% change in explanatory variables brings 92% variation in dependent variable which shows the Goodness of Fit of the model. Adjusted R square 0.896 shows the total variation in dependent variable after solving all the residuals that is 89% variation which is desirable.

4.7 Diagnostic Test

4.7.1 Normality Test



Histogram shows the normality of the model that the value of Skewness, Kurtosis and Jarque-Bera are significant at P value (0.20).

4.7.2 Table 7: LM and Heteroscedasticity Test

	F-statistic	Prob. F(2,16)	Obs*R-squared	Prob. Chi-Square(2)
Breusch-Godfrey Serial Correlation LM Test:	1.056	0.370	3.148	0.207
Heteroscedasticity Test Breusch-Pagan-Godfrey	0.608	0.759	5.743	0.675

Breusch-Godfrey LM test for serial correlation and Breusch- Pagan -Godfrey Test for heteroscedasticity shows the insignificant probability values and hence, accepting the null hypotheses such that that there is no serial correlation and heteroscedasticity problem in our model.

4.7.3 Table 8: Ramsey RESET Test

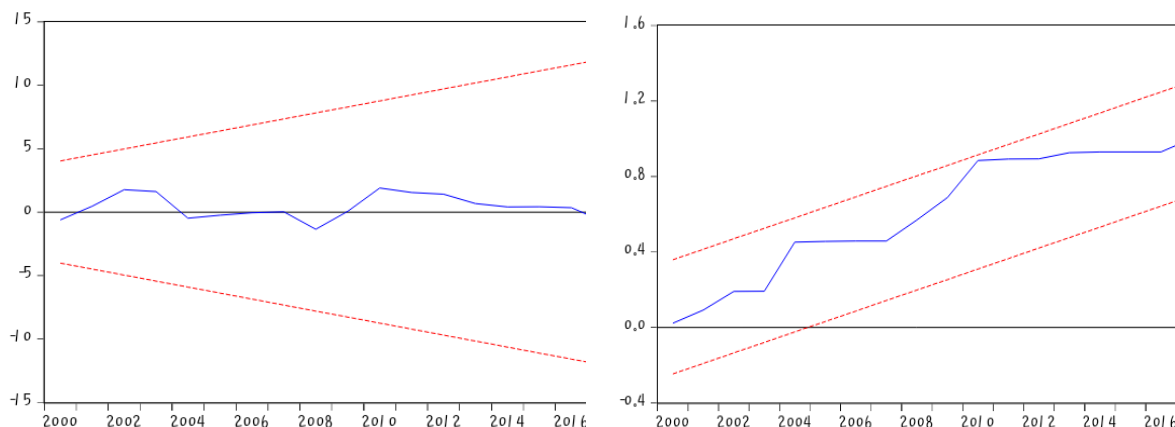
Value	Df	Probability	
t-statistic	1.771459	17	0.2944
F-statistic	3.138068	(1, 17)	0.2944
F-test summary:			
	Sum of Sq.	df	Mean Squares
Test SSR	4.8818	1	4.88118
Restricted SSR	3.1319	18	1.74418
Unrestricted SSR	2.6419	17	1.56618

H_0 : there is no normality issue.

The values of t (1.771) and F -stats (3.138) are insignificant, therefore, the null hypotheses is

accepted which indicates that there is no normality issue in the model.

4.7.4 Cusum and Cusum square test



Cusum and Cusum square tests are stability test of the model and our model is significant as the values lies between the critical regions at 5% in both Cusum and Cusum square test.

5 Conclusion and Recommendations

The ever-fluctuating oil rates in the international markets have caused serious concerns among the policymakers worldwide due to its consequential dominance in the economies of the globe. In this paper, an investigation of oil prices, exchange rate, gross domestic product, foreign direct investment and inflation on balance of payment is carried out by using the ARDL-Bound test approach for the years 1990 to 2025. The estimated result shows that the exchange rate has a positive relationship to the trade balance in short run while negative relation in long run at 1 % significance level. Foreign direct investment and oil prices have a negative relation to the balance of payment in both short and long run consensus with the study of Hussain et al., (2017). Finally, the Gross domestic product has a negative relation to the balance of payment in short run while inflation has a negative relation in both short and long run. ECM value (-0.779*) indicate the convergence to equilibrium at the rate of 77% in long run. The diagnostic tests also indicate that there is no serial correlation and heteroscedasticity in the model. Summing up, the result of this analysis depicts that an increase in prices of oil has adversely affected Pakistan's current account balance. The persistent upturn in oil imports should be controlled by Government to uphold its balance of payment. Oil import could be reduced by the production of its alternatives

renewable energy sources as Pakistan is endowed with the natural resources like wind, water and solar that is consistent to the study of Manju and Sagar (2017) & Faizi et al., (2025). Therefore, to fulfil the growing energy demand of the country government should utilize alternative available energy sources that are also environment -friendly as well.

Recommendations:

- Reduce reliance on oil imports by developing alternative energy sources like wind, solar, and water, leveraging Pakistan's natural resources.
- Implement import substitution and export-promoting policies to enhance trade balance.
- Adopt strategic monetary policies to combat inflation and stabilize the economy.
- Diversify energy mix to reduce vulnerability to international oil price shocks.
- Enhance economic resilience through sustainable energy development and trade diversification.

By addressing these areas, Pakistan can mitigate the adverse effects of oil price fluctuations and strengthen its balance of payments position.

6 Future Studies

Future studies could explore the potential of alternative energy sources, such as renewable energy, in reducing Pakistan's reliance on imported

oil and alleviating the pressure on its balance of payments. Investigating the impact of renewable energy adoption on Pakistan's energy mix and trade balance could provide valuable insights for policymakers. Additionally, research could examine the effects of other key determinants on Pakistan's balance of payments, including trade policies, financial institutions, and technology-related production processes. Analysing the impact of tariff structures, trade agreements, and export promotion strategies on trade balance, evaluating the role of banking sector development and financial inclusion, and assessing the impact of technological advancements on trade competitiveness could further enrich the understanding of Pakistan's balance of payments dynamics.

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