TAMSAAL
ISSN Print: 3007-5939
ISSN Online: 3007-5947
Volume 4, Number 7, 2026, Pages 205 – 216
Journal Home Page
https://tamsaal.pk/index.php/tamsaal/index

The Effect of Natural Resource Prices Volatility on Domestic Investment in Pakistan

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ARTICLE INFO

Article History:

Received:	*May*	*17, 2026*
Revised:	*June*	*20, 2026*
Accepted:	*July*	*09, 2026*
Available Online:	*July*	*15, 2026*

Keywords:

Natural Resources Price Volatility, Investment, Trade, Exchange Rate volatility, ARDL and Pakistan

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DOI: *https://doi.org/10.59075/tamsaal.v4i7.66*

ABSTRACT

This study aimed to measure the impact of Natural Resources Prices Volatility on investment in Pakistan for the period of 1990–2025. The nature of the data is time series therefore stationarity testing is required, and ADF tests used. Results stationarity test showed that the variables of the model are stationary at different levels. ARDL estimation technique is suitable for estimation in such like case. In the first step the outcomes of Bound test confirm the existence of long run relationship. From the results it is evident that the impact of natural resources price volatility affects domestic investment negatively and significantly. Moreover, the impact of public debt, and exchange rate instability are also found negative and significant in the long run. The outcomes of the present study supported the notion that any macroeconomic instability and public debt leads to declined investment because of the increasing risk and expected fall in profit. Conversely, the impact of trade openness showed a strong positive effect on investment showing that more connectivity with external markets and increasing integration encouraged investment. In the short-run outcomes showed quite similar notion as in the long run. i.e. natural resources price volatility and volatility in exchange rate discouraged investment. The impact of public debt provides a short term relief to investors. The coefficient of ECM is turned negative and significant confirmed that there is long run stable equilibrium in the model. Based on the outcomes it is suggested that a suitable environment can be provided to increase investment in Pakistan NRPV and PB, TO should be kept in policy coordination that can ensured long term economic growth.

Introduction

Natural resources and their prices are widely recognized as fundamental drivers of economic activity. In classical economic theory, land, minerals, and energy constitute essential factors of production, while in the modern global economy fossil fuels such as oil, natural gas, and coal have become indispensable inputs for industrial production, transportation, and electricity generation. Consequently, fluctuations in international resource prices have profound implications for resource-dependent economies by influencing inflation, inflation volatility,

investment decisions, and overall economic growth (Hamilton, 2003; Ali et al., 2019; Wang et al., 2022). The availability of natural resources varies considerably across countries, leading to differences in economic structures and socioeconomic development. Developing economies that rely heavily on imported energy are particularly vulnerable to external shocks because increases in international resource prices raise import bills, weaken external balances, depreciate domestic currencies, and undermine fiscal stability (Kilian, 2009). Pakistan represents a clear example of such vulnerability. As a developing country with substantial dependence on imported energy, its economy remains highly exposed to fluctuations in global resource prices. Since energy is an indispensable input in the production process, virtually every economy imports it to satisfy domestic demand, thereby strengthening its integration with international markets while simultaneously increasing exposure to external shocks.

An increase in international oil prices raises Pakistan's import bill and widens the current account deficit, resulting in downward pressure on the domestic currency. Currency depreciation subsequently fuels inflation, prompting the central bank to tighten monetary policy through higher interest rates. Although such measures are intended to contain inflationary pressures, they also increase borrowing costs and discourage private investment, thereby generating crowding-out effects (Malik, 2008). Conversely, higher resource prices may improve the profitability of energy-related industries and attract additional investment into the energy sector, creating crowding-in effects (Apergis & Payne, 2010). Therefore, the overall relationship between natural resource price fluctuations and investment remains theoretically ambiguous and requires empirical investigation.

The resource blessing hypothesis emphasizes the important role of natural resources in promoting economic growth and development. According to this perspective, natural resource abundance provides a necessary foundation for economic progress, while sustainable long-term development depends on complementary factors such as effective governance and strong institutional quality (Stevens, 2003; Van der Ploeg, 2021). Countries such as Norway and Botswana are frequently cited as successful examples of transforming resource wealth into sustained economic prosperity through sound institutions and effective resource management (Karl, 1997; Maipose, 2017). Fluctuations in commodity terms of trade increase uncertainty, reduce investment incentives, and ultimately slow economic growth. Similarly, Zhang et al., (2022) reported that resource price volatility negatively affects economic growth in several resource-rich countries. Bakhsh & Zhang (2023) further demonstrated that natural resource rent volatility, when combined with policy uncertainty, significantly weakens growth performance in developing economies. Likewise, Hayat & Tahir (2021) found that volatility in natural resource prices negatively affected Middle Eastern resource-abundant countries, providing empirical support for the natural resource curse hypothesis.

Another important dimension is that fluctuations in resource prices are increasingly influenced by developments in global financial markets. Developing countries, which are generally more dependent on international trade and foreign capital, are therefore more vulnerable to external financial shocks that destabilize their macroeconomic environment. Ali et al. (2025) argued that sustained economic growth requires a stable macroeconomic environment capable of encouraging long-term private investment. They further emphasized that good governance is essential for maintaining investor confidence. Thus, resource abundance alone is insufficient for economic development unless accompanied by a stable investment climate, effective institutions,

and sound macroeconomic policies (Wang et al., 2022; Liao, 2023).

Pakistan's recent economic experience illustrates both the adverse and potentially beneficial consequences of international resource price movements. The sharp rise in global oil prices during 2008 significantly increased inflation and the country's import bill. Similarly, the balance-of-payments crisis in 2018 was intensified by rising energy imports, discouraging private investment. More recently, global commodity price shocks during 2022 severely affected Pakistan's external balance, contributed to higher inflation, prompted increases in interest rates, and weakened investor confidence (Kilian, 2009). These episodes demonstrate how international resource price shocks influence domestic investment decisions through multiple macroeconomic transmission channels. Despite these challenges, Pakistan possesses substantial natural resource potential capable of supporting long-term economic development if utilized efficiently. Approximately 39 percent of the country's land is suitable for agriculture, supported by extensive river systems that provide significant water resources (World Atlas, 2020). Pakistan also possesses abundant mineral wealth estimated at approximately US$6 trillion. The country holds one of the world's largest lignite coal reserves in the Thar coalfields, estimated at between 175 and 200 billion tonnes. In addition, Pakistan possesses significant copper and gold deposits, including one of the world's largest undeveloped copper-gold reserves, as well as approximately one billion tonnes of salt reserves. Other important mineral resources include barite, chromite, gypsum, limestone, and marble (Modern Diplomacy, 2025). Therefore, it is suggested that volatility in natural resources rent can possibility affect investment in developing countries.

Research Methodology

Resource price volatility significantly influences private investment, particularly in resource-dependent economies, through several theoretical channels. According to the real options theory, greater price uncertainty encourages firms to postpone irreversible investment decisions until market conditions become more predictable (Dixit & Pindyck, 1994). Similarly, the accelerator theory suggests that volatile resource prices reduce expected demand and income growth, thereby discouraging private investment (Blejer & Khan, 1984). The resource curse hypothesis further argues that resource price booms may appreciate the real exchange rate (Dutch disease), reducing the competitiveness of non-resource sectors and limiting productive private investment (Auty, 1993; Sachs & Warner, 2001). In addition, financial frictions theory emphasizes that price volatility weakens firms' balance sheets, tightens credit constraints, and lowers investment (Bernanke, Gertler, & Gilchrist, 1999), while institutional theory highlights that weak governance amplifies the adverse effects of volatility through greater policy uncertainty and rent-seeking (Mehlum, Moene, & Torvik, 2006). Empirical evidence largely supports these theoretical predictions. Aizenman and Marion (1999) found that macroeconomic volatility reduces private investment, particularly in developing countries. Ramey (2006) showed that output volatility negatively affects capital formation, while Van der Ploeg and Poelhekke (2009) reported that natural resource price volatility slows economic growth by reducing investment and increasing macroeconomic instability. The impact of resource prices on private investment can be explained through two competing mechanisms. The crowding-out effect suggests that higher oil, gas, and coal prices increase production costs, inflation, borrowing costs, and exchange rate pressures, thereby discouraging private investment (Bernanke, 1983; Hamilton, 2003). Conversely, the crowding-in effect argues that rising energy prices improve the profitability of energy-related industries, stimulating investment in energy exploration, renewable energy, and

infrastructure (Apergis & Payne, 2010). Consequently, the overall effect of resource price volatility on private investment remains an empirical issue, particularly in resource-dependent economies such as Pakistan.

This study followed the research work done by Parveen et al., (2021); Zhang et al, (2021); X Ni, et al., (2022); X Ni. et al, (2022); Liao et al., (2023) for model of the study. The empirical model is described as under:

$Inv_t = \alpha + \beta_1\ NRRV_t + \beta_2\ GDPG_t + \beta_4 INFV_t + \beta_4 REE\ R_t + \beta_5 Trd + e_t$

Where, Inv= Investment (gross fixed capital formation) GDP_t = Real GDP (GDP growth)

IN FV_t = Inflation rate (CPI) *REE* R_t = Exchange rate

Trd_t = trade as % of GDP PD= Public debts % of GDP

To estimate the required model ARDL technique is defined as under:

$$INV_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i INV_{t-i} + \sum_{j=0}^{q} \beta_j NNRV_{t-j} + \varepsilon_t$$

And error correction model can be written as under:

$$\Delta INV_t = \alpha_0 + \sum_{i=1}^{p-1} \alpha_i \Delta INV_{t-i} + \sum_{j=0}^{q-1} \beta_j \Delta NNRV_{t-j} + \lambda_1 INV_{t-1} + \lambda_2 NNRV_{t-1} + \varepsilon_t$$

Results and Discussions

The results section is further divided into two subsections i.e. descriptive results and analytical results. Descriptive statistics help in understanding the overall trend, variability, and distribution of the data before moving to econometric analysis.

Table-1: Descriptive Statistics outcomes

	INV	NRRV	TRD	INFV	PD	RER
Mean	10.9405	3.2963	24.4944	22.4096	24.614	107.4838
Maximum	16.2000	8.3588	25.2522	118.945	25.699	126.6364
Minimum	6.8000	0.1421	23.5600	0.0135	23.751	91.4146
Std. Dev.	1.9933	2.1403	0.52801	31.7572	0.5793	9.9021
Skewness	0.8138	0.6144	-0.2212	1.8748	0.378	0.4088
Kurtosis	3.7321	2.3797	1.5849	5.6969	1.881	1.7625
Jarque-Bera	4.6449	2.7631	3.2055	31.1124	2.660	3.2083

The results of the ADF test is presented in the following table-2. It is clear from the t-values and probability values that all the variables are stationary order-1 except GDP growth.

Table-2: ADF test Outcomes

Variables	ADF Level		Difference		Decision
	T- Test	Probability	T- Test	Probability	
INV	-1.902	0.079	-4.763	0.000	**I(1)**
GEXP	-1.1092	0.698	-5.3738	0.000	**I(1)**
INF	-2.111	0.241	-6.7602	0.000	**I(1)**
PD	-2.0496	0.2653	-4.9219	0.000	**I(1)**
TO	-1.753	0.3952	-3.5707	0.004	**I(1)**
GDPG	-4.7255	0.000	----	-----	**I(0)**

It is clear from the values of the unit root tests in table-3 that all the variables are of order first I(1) means that the variable become stationary after first difference except GDPG. Therefore, accurate estimation technique is ARDL.

The ARDL bounds test is used to determine whether a long-run equilibrium relationship exists between domestic investment and its determinants, including natural resource price volatility, trade openness, inflation volatility, public debt, and the real exchange rate. This approach is appropriate because it accommodates variables integrated at either I(0) or I(1). The estimated F-statistic (14.74) is well above the upper bound critical values at the 1%, 5%, and 10% significance levels, leading to the rejection of the null hypothesis of no cointegration. The findings confirm a stable long-run relationship among the variables, indicating that although domestic investment may experience short-run fluctuations due to macroeconomic shocks, it eventually converges to its long-run equilibrium. This suggests that natural resource price volatility, trade openness, inflation volatility, public debt, and the real exchange rate exert significant long-term effects on domestic investment in Pakistan, justifying the estimation and interpretation of the ARDL long-run coefficients. Bound test is used to tell us about the existence

of the long run relationship between the variables of the selected model. Its decision is based on the comparison of the calculated test-statistic value and critical bounds values. Here in case of the present study the value of the test statistic is 14.73740 which is higher than the value of the upper bound critical value which shows that there is long run relationship between the variables of the mode. And this study should proceed to the next step of the long run and short run estimation on of the parameters.

Table-3: Bound test Results

ARDL Bounds Test		
Null Hypothesis: No long-Run Relationships Exist		
Test Statistic	Value	K
F-statistic	**14.73740**	6
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
5%	2.45	3.61
1%	3.15	4.43

The long run results in Table-4, the coefficient of Natural Resource Rent/price Volatility variable is turned to be negative and statistically significant at the 1% level significance. This indicates that a 1% increase in the volatility of natural resource revenues leads to decease the investment by 0.42% in case of Pakistan. The finding of the present study is strongly supported by the outcomes of the studies conducted by the uncertainty-investment nexus, which stated that high volatility in resource prices creates an unpredictable economic environment, causing firms to adopt a "wait-and-see" strategy and defer capital-intensive projects is also supported by Hou, F. et al., (2025). This notion of the study is parallel to the consensus that in industrial sector high sunk costs, where investment is largely irreversible (Ashfaq, & Abbas, (2025). In case of the country Pakistan, petroleum products prices volatility has been significantly reduced aggregate output and discourage investment.

The long run coefficient of the variable trade openness i.e. 1.1249 with corresponding probability value 0.000, showing a highly significant positive impact. This suggests that as Pakistan becomes more integrated into global trade, domestic investment increases substantially. Increased trade openness facilitates access to international markets, technology transfers, and competitive pricing for capital goods, all of which stimulate domestic investment. Literature suggests that for emerging economies, trade liberalization acts as a catalyst for industrial progress and infrastructure enhancement (Kayani et al., 2023).

The long run coefficient Inflation volatility is 0.0186 with corresponding probability value 0.0957, which is significant at the 10% level. While the impact is positive, the magnitude is relatively small. Typically, macroeconomic uncertainty often measured by inflation or its volatility is expected to hinder capital formation (Ashfaq & Abbas, 2013). However, a slight positive correlation can sometimes occur in developing nations where investors shift capital into real assets (like property or machinery) as a hedge against currency devaluation (Munir & Iftikhar, 2023). Nevertheless, it is generally noted that high inflation eventually depresses financial development by increasing borrowing costs (Ijaz et al., 2023).

The long run coefficient of Pubic debts found negative and statistically significant means that a strong negative long-run impact on investment. Your result aligns with previous ARDL studies in Pakistan that found public debts can exert a negative impact on domestic production and leads to leakage to foreign countries which natively affect domestic investment. High public debts increased become the major source of capital flight to outside the county and leads to domestic capital resource depletion and "common-pool" problems, which may divert funds away from productive domestic investment toward immediate consumption or unsustainable public spending (Ploeg, 2010).

The long run coefficient for RER is negative and highly significant impact on investment which means that an increase in RER leads to decrease investment in case of Pakistan and this notion is supported by i.e. exchange rate instability increases risk and diminishes the projected profitability of investment projects. A descending pattern or high volatility in the Pakistani rupee often makes the cost of imported machinery and technology more expensive, thereby hindering domestic capital formation (Munir & Iftikhar, 2023). This is consistent with findings that exchange rate fluctuations exacerbate economic policy uncertainty, discouraging both domestic and foreign direct investment.

To sum up with the outcomes it is concluded that Natural Resource Revenue Volatility is a significant barrier to domestic investment in Pakistan. The negative impact of and suggests that price and currency stability are paramount for encouraging capital growth. Conversely, the strong positive impact of suggests that policies promoting trade openness are highly effective in fostering an environment conducive to investment.

Table-4: Long Run Estimates (ARDL)

LONG RUN COEFFICIENTS				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
NRRV	-0.4221	0.1395	-3.0240	0.008
TRD	1.1248	0.0760	14.800	0.000
INFV	0.0186	0.0104	1.7778	0.095
PD	-0.4096	0.0831	-4.9290	0.000
RER	-0.1226	0.0219	-5.5858	0.000
C	0.5021	0.7581	0.6623	0.408

Table-5 presented the short-run dynamics derived from the ARDL Error Correction Model provide insights into the immediate effects of explanatory variables on investment in Pakistan. The coefficient of the lagged dependent variable 0.813 is positive and statistically significant at the 1% level, indicating strong persistence in investment behavior. This suggests that past investment decisions significantly influence current investment levels, reflecting adjustment costs and inertia commonly observed in capital formation processes in developing economies (Ashfaq & Abbas., 2013).

The short-run coefficient of natural resource rent volatility -0.7738 is negative and statistically significant at the 5% level. This implies that an increase in resource revenue volatility immediately reduces investment in the short run. The result supports the uncertainty hypothesis, where sudden fluctuations in resource revenues increase risk perceptions and lead investors to

postpone or scale down investment decisions (Hou, F., Chen, H., & Ali, S. 2025). This finding is consistent with earlier studies highlighting that short-term uncertainty, particularly from energy markets, discourages private sector confidence and reduces investment in risky assets.

Trade openness is found positive and statistically significant at level and 2nd lag. Which suggesting that short-term increases in trade flows stimulate investment through improved market access and availability of imported capital goods. The same is also supported by Almasria, N. A et al., (2024) i.e. it reflecting short-run adjustment frictions and transitional costs associated with changes in trade policy. Inflation volatility shows weak and insignificant short-run effects on investment. Public debt dynamics reveal that the contemporaneous change in public debt is significant, whereas the first lag 13.044 is positive and significant at the 5% level. This indicates that short-run increases in public debt may temporarily stimulate investment, possibly through expansionary fiscal measures or public spending that "crowds in" private investment. However, this short-run effect contrasts with the negative long-run impact, implying that debt-financed spending may provide only temporary relief before potentially leading to pro-cyclical fiscal instability.

The short-run coefficient of the real exchange rate RER -0.1534 is negative and statistically significant at the 1% level, indicating that an appreciation or instability in the exchange rate immediately discourages investment. Exchange rate fluctuations increase the cost of imported machinery and inputs, raising uncertainty and reducing the projected profitability of investment projects in the short run (Iftikhar, F., Husnain, M., Munir, Q., & Ali, S. (2023). This highlights how macroeconomic uncertainty, often derived from exchange rate movements, serves as a primary deterrent to capital accumulation in Pakistan (Ashfaq & Abbas., 2013).

Most importantly, the error correction term -1.833 is negative, highly significant, and greater than unity in absolute value. This confirms the existence of a stable long-run relationship among the variables and indicates that the results are not spurious. The magnitude of the coefficient suggests that deviations from long-run equilibrium are corrected rapidly, with more than 100% of the disequilibrium adjusted within one period. This indicates a strong and efficient adjustment mechanism toward long-run equilibrium following short-run shocks. In summary, the short-run results reveal that natural resource revenue volatility and exchange rate movements act as immediate deterrents to investment in Pakistan, while trade openness provides short-term stimulus. Inflation volatility and public debt exhibit delayed and mixed effects. The significant and negative error correction term reinforces the robustness of the ARDL model and confirms that short-run fluctuations converge quickly toward long-run equilibrium.

Table-5: Short Run Estimates (ARDL)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INP(-1))	0.813847	0.255598	3.18409	0.0062
D(NRRV)	-0.773881	0.264435	-2.92655	0.0104
D(TRD)	1.594941	0.454378	3.510163	0.0024
D(TRD(-2))	0.591218	0.318519	1.856147	0.0112
D(INFV)	0.009253	0.006817	1.357342	0.1947
D(PD(-1))	3.044376	0.634340	4.799281	0.0352
D(RER)	-0.153412	0.049183	-3.11921	0.0070
CointEq(-1)	-1.833279	0.388273	-4.72162	0.0003

The Breusch–Godfrey Serial Correlation LM test results indicate that the null hypothesis of no serial correlation cannot be rejected. The F-statistic value of 0.2711 with a corresponding probability value of 0.7667 is statistically insignificant. Similarly, the Obs*R-squared statistic reports a probability value of 0.5270, which is well above the conventional significance levels. These results confirm the absence of autocorrelation in the model residuals, implying that the error terms are independently distributed over time. This validates the dynamic specification of the ARDL model and suggests that the estimated coefficients are unbiased and efficient.

The Breusch–Pagan–Godfrey test for heteroscedasticity further confirms the robustness of the model. The F-statistic value of 0.4195 with a probability of 0.9525 is statistically insignificant, indicating that the null hypothesis of homoscedasticity cannot be rejected. In addition, the R-squared statistic and the Scaled Explained Sum of Squares also show high probability values of 0.8722 and 1.0000, respectively. These findings demonstrate that the variance of the residuals is constant across observations, and there is no evidence of heteroscedasticity in the model.

Table-6: Diagnostic Tests Results

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.271109	Prob. F(2,13)	0.7667
Obs*R-squared	1.281250	Prob. Chi-Square(2)	0.5270
Heteroscedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.419464	Prob. F(16,15)	0.9525
Obs*R-squared	9.891823	Prob. Chi-Square(16)	0.8722
Scaled explained SS	0.885664	Prob. Chi-Square(16)	1.0000

Conclusion

This study aimed to examine the impact of Natural Resources Prices volatility on investment in Pakistan. For this purpose, this study collected annual time series data over the period of 1990 to 2025 using a ARDL modeling framework. The preliminary analysis, conducted through descriptive statistics and correlation matrix, validated the joint inclusion of these variables by ensuring the absence of serious multi-collinearity. Unit root results indicated a mixed order of integration, with variables being either or, thereby justifying the application of the ARDL bounds testing approach.

The bounds test results confirmed a stable long-run co-integrating relationship between domestic investment and the selected factors: natural resource revenue volatility, trade openness, inflation volatility, public debt, and the real exchange rate. Long-run estimates highlighted that natural resource revenue volatility, public debt, and real exchange rate instability significantly hinder domestic investment in Pakistan, illustrating the detrimental impact of macroeconomic and fiscal uncertainty. Specifically, high volatility in resource revenues discourages capital-intensive projects due to increased risk and the irreversible nature of such investments. Conversely, trade openness emerged as a robust positive driver, underscoring the importance of global integration and access to technology for sustained capital formation.

Analysis of short-run dynamics revealed that investment behavior in Pakistan exhibits strong persistence, reflecting the adjustment costs typical of developing economies. In the short run,

natural resource revenue volatility and exchange rate fluctuations act as immediate impediments to investment. While public debt may provide temporary support through expansionary measures, its long-term influence remains negative. The error correction mechanism confirmed a rapid adjustment toward long-run equilibrium, indicating that the investment sector responds efficiently to macroeconomic shocks.

Finally, diagnostic and stability tests confirmed the econometric soundness of the model, showing that the residuals are normally distributed and free from serial correlation or heteroscedasticity. Overall, these findings suggest that maintaining macroeconomic stability particularly regarding resource revenues, exchange rates, and fiscal management while promoting trade is essential for fostering an investment-friendly environment in Pakistan. These results provide important policy implications for sustaining long-term domestic investment and economic growth. Overall, the study concludes that macroeconomic stability particularly in resource prices, exchange rates, and fiscal policy is crucial for promoting domestic investment in Pakistan, while trade openness serves as a key driver of investment growth. These findings provide important policy implications for fostering a stable and investment-friendly economic environment to support long-term growth.

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