



Interlinkages between Foreign Direct Investment, Energy Consumption, and Economic Growth: Empirical Evidence from Pakistan

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Abstract

This study aims to analyze the short and long-run relationship and causal association among foreign direct investment, energy consumption, and gross domestic product (a proxy of economic growth) and time series data used from 2000 to 2020, which is obtained from World Development Indicators (WDI) and State Bank of Pakistan SBP. The unit root ADF test was applied for stationary, and one variable was stationary at level, one at the first difference and one at the second difference. ARDL & Wald Test were employed to see short and long-run causal associations among variables of interest. Further; for Model Specification, Histogram, Breusch-Pagan Test, Ramsey Reset Test, CUSUM & CUSUM Squares tests were applied. The trend analysis of energy production & usage has a very considerable gap despite being a major receptor of FDI inflows in Pakistan. Further results confirm short- and long-run causal association between FDI and energy consumption with the GDP of Pakistan. Considering the current situation in Pakistan, policymakers should formulate policies that consider minimum levels of debt and discourage loan-based investments. Such efforts would be helpful to mitigate the energy sector problems and ultimately enhance the economic growth of Pakistan.

1 Introduction

The incorporation of developing and least developing economies rapidly rose during the 1990s thanks to economic policy reforms that lowered the foreign trade and investment barriers. Nowadays, investment is considered a vital factor for any economy's development. Specifically, (FDI) is expected to bring prosperity to poorer regions. Consequently, there is strong competition among developing economies to attract FDI, which is crucial in numerous ways for third-world countries like Pakistan. It brings capital into the country, creating true externalities like employment opportunities for the local population, allocation of technology, professional skills, Research & Development, increased efficiency, and innovative production methods.

Additionally, it encourages domestic investors to confidently invest in their home country (Latief & Lefen, 2018). Despite various economic and political instability, Pakistan continues to rely heavily on foreign investors globally. The Pakistani government has undoubtedly focused on and assumed investment-oriented policies to attract FDI and create opportunities.

Pakistan predominantly receives Foreign Direct Investment (FDI) from various countries around the globe, including China, the United States, Saudi Arabia, Norway, Japan, the United Kingdom (UK), Switzerland, and, lastly, Hong Kong. A few other countries are involved, but the significant contributions come from the aforementioned nations. FDI is primarily targeted towards several sectors in Pakistan's economy, including the energy, financial, commerce, trade, engineering and construction, textile, and transport sectors. The energy sector receives the largest share of Foreign Direct Investment (FDI) and is a crucial budget component. Recognizing its extreme importance, the Pakistani government has reformed energy sector policies and even offered incentives to attract investors globally.

Energy is the key ingredient for a productive economy. Likewise, a rise in production will increase the energy demand for EC (Shahbaz & Lean, 2012). The degree of energy consumption is directly proportional to the overall growth and development of the economy. Consequently, energy consumption (per capita) is used as a substitute way to quantify the overall progress of any nation or state. As Pakistan's population has increased, its energy demand and consumption are similar to those of the developing world. Apart from that, rapid industrialization and urbanization have also demanded more energy use. Pakistan is experiencing severe energy crises and challenges because this sector has no proper governance and an extreme reliance on oil and gas resources. Apart from this, this sector has a de-rated capability. The major concern in this division is circular debt, and lastly, the security and threats of the energy division. To overcome these challenges and the energy crisis, the Government of Pakistan (GOP) has to formulate sophisticated policies that discourage loan-based investment to attain a low level of debt.

Considering Pakistan's experience, it is bestowed by nature with different minerals. The upsetting thing is that Pakistan has not utilized this blessing utterly; even its major resources remained unexploited for decades. This is the key factor Pakistan has faced severe energy

shortages and very few investments in energy infrastructures. Insufficient energy service has become Pakistan's biggest barrier to economic growth and development. Expanding the energy sector certainly leads to greater economic progression; on the contrary, the country's energy shortage may become a barrier to the economic process. Now, it has been realized that the availability of reasonable energy services is mandatory to reduce poverty and achieve sustainability in economic growth (Shah et al. 2023).

To what extent have the policies of the Pakistani government been successful in catching inadequate foreign direct investment (FDI), and how much have these foreign investments backed the economy of the country? These are the major problems to be probed properly and have a purposeful eye on FDI and Pakistan's energy sector. In the context of Pakistan, as far as I understand, no practical research study has been conducted to examine the degree of association and movement of FDI, energy consumption, and its ultimate influence on the overall economy of a country. Most of these researchers have focused on the association between FDI and the economic progression of a country. The research study tests the causality between Pakistan's FDI, energy consumption, and economic progress. The study also analyzes the trends of FDI flows in Pakistan. An econometric estimation is employed to assess economic progress with the help of FDI and energy consumption; the estimation depends on data from various reliable sources. The study considers the progress of the energy sector and major barriers that sluggish the performance of this sector and, ultimately, the economy of any country. Ultimately, the research study recommends the policy's implications (Nasriddinov et al. 2022).

During the 1990s, Pakistan had lower energy requirements than other third-world and well-developed economies except for a few countries like Nepal and Sri Lanka. This is because Pakistan has lower energy intensity and, in other aspects, the low-level availability of energy. The prosperity of energy intensity stagnated and remained static from 1993 to 1996. The prosperity is measured using a proxy, the Per capita energy availability. This illuminating fact is that Pakistan is comparatively weak regarding energy availability.

On the other hand, the growth rate of commercial energy usage is almost the same as that of other regional developing economies, such as India and China. Pakistan's per unit of energy about gross domestic product (GDP) was lowered compared to other countries. The growth rate of energy use per unit of gross domestic product is also lower than in other

developing countries such as India, Bangladesh, and Nepal; the energy use per unit of GDP has lowered from 1990 to 1997, from 3.3 percent to 2.8 percent, respectively.

The fraction between the growth rates of energy used and energy output produced indicates the level of energy intensity; from 1970 to 2003, energy intensity remained around 0.96 percent. Over the period, there has been a swift change in the energy intensity of energy sources, petroleum products, gas, and electricity. Taking an overview of specific sources, the energy coefficient for electricity use is 1.19 and 1.51 for commercial and total use, respectively. It indicated that the enclosure of home-based electricity consumption overestimates the coefficient of energy. The same is true when we exclude the domestic consumption of gas and petroleum products. The coefficient of these sources also varies significantly. But the change rate is largest for electricity (Wang et al. 2023).

By enhancing technology, a reduction in energy waste might decrease the coefficient as fuel use increases. This directs the GOP to consider the efficient usage of energy apart from focusing on energy expansion sources. The focus should not be on more sources, but obvious efforts should be put into efficiently using energy with minimum waste. This is the critical issue of how efficiency will come. The other serious concern to consider is the role of the pricing mechanism (Riaz, 1984).

Over time, the production and consumption of energy have worsened in Pakistan. The situation had deteriorated because of various factors involved. Examples are that energy production remained highly dependent on oil and gas resources, restraining demand for oil in terms of quantity and giving lesser consideration to hydro projects. The energy sector has been facing an intense problem of circular debt, lack of funds, and inability to utilize the available resources up to the mark due to bad governance. The major issue remaining in this sector is unnecessary political involvement and influence.

This clearly shows that in most recent years, there has been a steady increase in net energy imports, but on the other hand, there is a swift increase in the commercial use of energy. Like developing countries, Pakistan has opted to import oil and LNG from the Arabian nation to fulfill its energy requirements. Pakistan imports LNG from Qatar. Now, Pakistan has decided to import electricity directly from countries like Tajikistan and

Kyrgyzstan; apart from this, Pakistan also looks forward to developing numerous energy projects under the major project, the Pakistan Economic Corridor (CPEC) (Tahir 2023).

Pakistan's population has been on an increasing trend for many years, so the energy requirements in the country are swiftly increasing. The Government of Pakistan has made measurable efforts to ensure that there is an adequate level of energy. Apart from that, there should be a sustainable enlargement of natural resources. A country like Pakistan has various natural resources such as hydro and coal assets. Properly utilizing these crucial resources could overcome the country's energy needs in the future. The policy offers various incentives to attract internal and overseas investors' intentions towards energy sector projects. The policy had some main purposes, which are as follows: (1) the supply of sufficient and efficient power production capacity with lower cost. (2) The boost up and ensure the proper and appropriate utilization of domestic resources. (3) To gain the confidence of all stakeholders by providing a win-win situation in the process. (4) Consider environment-friendly production to secure the environment(2017–2018).

FDI inflows in various sectors of Pakistan indicate that the energy sector of Pakistan is the major receptor of FDI inflows among all divisions of Pakistan, which collects about 35.58 percent of total FDI; after this, communication and financial business sectors are the sectors that take major chunks of FDI around 24.26 & 21.26 percent respectively during the recent past years. The growth of FDI in the energy sector has significantly contributed to Pakistan's overall economic growth. Figure 4 highlights the linkage between FDI inflows towards Pakistan's energy sector and economic advancement. The graph depicts that both FDI in the energy sector and the economy have an upward trend in the initial period, and the FDI trend remains upward till 1998. To declare itself as an atomic power in the world, Pakistan decided to test nuclear missiles during the year 1998. The testing of nuclear leads to an economic sanction from the international community. This has weakened Pakistan's economic perspective, and as a result, there has been a downward trend in FDI.

The other factors that affected the downward FDI inflows were political disorder and the safety circumstances in the country. After that, in 1999, Pakistan encountered political instability that worsened the whole country's situation, which ultimately took the military government route. The military imposed an emergency in the whole country and took the rope into the hands of the administrator country. Military alleged that the civilian elected

government had failed to deliver and worsen the political environment. Subsequently, the massacre of 9/11 occurred in the United States of America. Pakistan took a step forward and participated in the war against terrorists.

Consequently, Pakistan faced numerous problems, such as the paralyzed security situation. This leads to investors' mistrust, and foreign investors become reluctant to invest in the country. It took some years to come out of this worsening situation. Afterward, Pakistan started better relationships with various nations, and apart from that, the security and political environment were harmonized, which led to a stabilized situation. As a result, Pakistan became successful in getting more FDI inflows during the tenure of 2005-2008, which can be seen from a graph showing that FDI showed an upward trend during that era. Since 2002, the economy has shown a steady upward trend in development on average. In 2009, however, a mixed trend emerged, indicating some variability in future projections.

FDI plays a major role in any country's economy; it changes the structure of industries and brings productivity. As a major receiver of FDI, Pakistan's energy sector is therefore essential to study its overall contribution to the economy of Pakistan (Latief & Lefen, 2018). This research study aims to check the causality between FDI, economic progress, and energy consumption in Pakistan. To provide empirical evidence that helps the authorities to strategically plan for policy development and decision-making.

This study aims to analyze the association between Energy consumption FDI and the Economic growth of Pakistan. This study aims to determine how these indicators affect each other to cope with the current situation by considering Pakistan is an importing country at risk of default. So that we can have an understanding of how much FDI and Energy are essential for Pakistan, which causes serious problems in the country with this research, a significant idea will be given to the people of Pakistan

As a developing country, Pakistan has increasingly relied on FDI to stimulate economic growth, industrial development, and infrastructure improvements. At the same time, energy consumption in Pakistan has risen sharply, driven by the expanding industrial base and population growth. However, Pakistan also faces significant energy challenges, including supply shortages, fossil fuel dependency, and energy use inefficiencies, which can hinder economic progress.

Understanding the causal linkages among these three variables FDI, energy consumption, and economic growth, is crucial for policymakers aiming to foster sustainable economic development. Given the need for strategic energy planning and the attraction of foreign investments to stimulate growth, examining the dynamics of this relationship can help formulate integrated policies that balance the need for energy security with the promotion of investment and economic expansion. Additionally, Pakistan's unique energy landscape, characterized by frequent shortages and a reliance on non-renewable sources, presents an important case for understanding how energy efficiency and investment strategies can be aligned for growth.

While there is a growing body of literature examining the relationship between FDI, energy consumption, and economic growth, much of the existing research has focused on developed or other emerging economies, with limited attention paid to the specific conditions of Pakistan. Most studies examine FDI or energy consumption in isolation, overlooking the potential interaction between these variables and their combined impact on economic growth.

Moreover, many existing studies fail to consider the bidirectional or multi-dimensional relationships that could exist between these variables. For instance, FDI may drive economic growth and influence energy consumption patterns by fostering energy-intensive industrial activities. Conversely, the availability and efficiency of energy resources may affect the level of FDI that a country attracts. These complex relationships are often underexplored in the context of Pakistan.

Additionally, previous studies have rarely incorporated recent data reflecting Pakistan's evolving energy policies, its focus on renewable energy, and its efforts to attract sustainable investment. Thus, a comprehensive study that employs advanced econometric models to explore these dynamic linkages using contemporary data remains lacking.

The study makes significant contributions by examining the dynamic relationships between these three crucial variables within Pakistan's economy. It provides empirical evidence on how Foreign Direct Investment (FDI) influences economic growth, highlighting the role of FDI in capital formation, technology transfer, and employment generation. Additionally, the study explores how energy consumption drives economic

activities, emphasizing the critical importance of energy in sustaining growth. The findings contribute to Pakistan's energy sector challenges and its role in economic development, suggesting that improved energy efficiency and investment in sustainable energy sources are vital for long-term growth. Furthermore, the research sheds light on the role of FDI in developing Pakistan's energy infrastructure, essential for addressing the country's persistent energy shortages. The study linking energy consumption with economic growth provides valuable insights for policymakers to develop investment-friendly policies and improve energy regulations, making the sector more attractive to foreign investors. This research fills a gap in the existing literature by focusing on Pakistan, offering both short-term and long-term insights into the FDI-energy-growth nexus and highlighting implications for sustainable development. It serves as a guide for policymakers aiming to balance foreign investments, energy security, and economic growth, ultimately contributing to the achievement of sustainable development goals in the country.

2 Literature Review

2.1 Foreign Direct Investment and Economic Growth

The literature review in economics about the connection between FDI and Economic growth revolves around two main theories of development; one of them is Modernization and the other one is the theory of dependency(Khatun & Ahamad, 2015). According to modernization theory, foreign direct investment (FDI) is useful for commercial progress, depending on the significance of capital invested in achieving growth. FDI is the major factor behind the transfer of technology from developed economies to the developing world, which also helps enhance the domestic industry with their assistance. Due to insufficient resources, most developing economies face problems of poor infrastructure and political and economic instability. The flow of FDI comes in terms of money and brings an adequate level of knowledge to that country. Apart from this, the country has marketing expertise, various managerial skills, and several opportunities. This is generally believed said by (Adams, 2009). FDI could help bring capital accumulation and enhance factor productivity (Nath, 2009) (Latief & Lefen. (2019).

Contrary to this, the dependency theory is proposed, (Bornschier, 1980) and (Stoneman, 1975). According to the research findings, FDI inflows can negatively affect economic advancement in the long run. The fundamental reason behind this is the mining of crucial

resources and the transfer of those resources to first-world countries from third-world countries after World War II. The reason behind continuous poverty in third-world countries is that these were inadequately rewarded for their natural resources. Capitalism, founded by theorists, causes labor division at a global level. Due to these reasons, FDI could pose obstacles to economic development. Apart from this, it could enhance the degree of income level inequality, negatively impacting economic progress in the long run. The empirical literature on the studies that have particularly worked on FDI in energy and its ultimate impact on the overall economy is hardly available. One of the particular studies undertaken by (2015) reveals no causality amongst FDI inflows towards the energy sector and economic progress in both the long & and short run. The empirical research study applied the Granger Causality tool, and the research context was Bangladesh. Apart from this, the empirical study used Pakistan as a sample size and undertaken the time series variables data for the period of 1990-2017. The purpose of the study was to determine the causality among FDI in Pakistan's energy sector, energy usage, and economic output. The Johansen Co-integration and, apart from that, the Granger Causality techniques were employed, and outcomes revealed that energy consumption and economic growth have a positive bi-directional short-run causal affiliation. Long-run causality exists in the energy consumption equation (Latief & Lefen, 2018).

The empirical research targeted the link between FDI inflows and economic progress. The following is the empirically tested research that has taken multiple countries to analyze the association According to the study of (Gupta & Singh 2016), which used panel data from 1992 to 2013 in the BRICS context. The study used various techniques to investigate the data of BRICS nations. The techniques were as follows: ordinary least square, Johansen Co-integration, and VECM. Based on these, the study results depict a causal linkage between FDI and Output for China, Brazil, and India. The result also illustrates a short-run causal connection between FDI and output in China. The study took data from 1971-2010, and the sample size used in this study was 124 countries. The generalized methods of moments (GMM) and the fixed effect model (FEM), these two models were applied. The output of the research study expresses that there is a direct bond between FDI and economic output.

In contrast, trade freedom, economic candidness, and the labor force are key elements of FDI, and these were established to accelerate economic output (Iamsiraroj, 2016).

Likewise, the panel data of various nations was used to see the nexus among output, energy consumption, and FDI for 1190-2011. By income level, the panel datasets were divided into three sub-panel datasets. The output of the analysis illustrates a bi-directional association between FDI and output in some of the nations out of 65 countries. To analyze the results, the author applied simultaneous equations with GMM (Omri & Kahouli, 2014). According to the study (Agrawal, 2015) that used panel Co-integration and VEC-specified Granger Causality techniques on BRICS nations from 1989 to 2012, the results support causality between FDI and output.

2.2 FDI Inflows Towards the Energy Division and Economic Output

Empirical studies particularly focused on variables such as FDI's impact on energy division and economic output. Empirical research has established a nexus by properly examining energy consumption and economic growth. To the best of my knowledge, only two studies have been conducted before those focused specifically on FDI in the energy sector and its ultimate causal association with economic growth. One of the particular studies undertaken by (2015) reveals no causality amongst FDI inflows towards the energy sector and economic progress in both the long and short run. The empirical research applied the Granger Causality techniques, and the study context was Bangladesh. Apart from this, there is one more study in the context of Pakistan that has undertaken these variables from 1990 to 2017. The study aims to determine the causal link between FDI inflows in Pakistan's energy division, output, and consumption. The analysis of the empirical study reveals that output and energy usage have a bi-directional linkage in the short run. In the long run, a causal linkage is present in the energy consumption equation, as depicted by the study's outcome. The techniques used to see the result are the Unit Root Test, Johansen Co-Integration, and Granger Causality (Latief & Lefen 2018).

2.3 Energy Consumption and Economic Growth

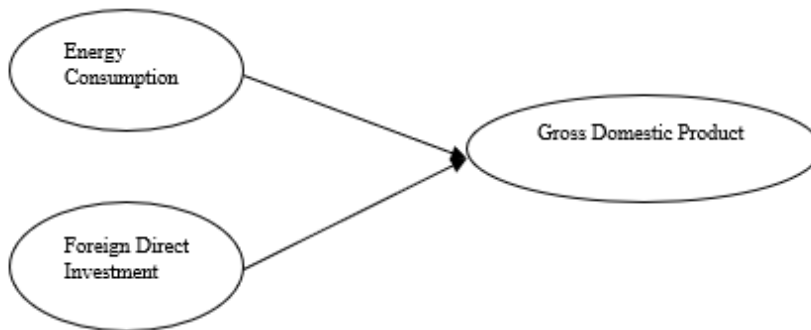
The Neo-Classical economic model of economic progression doesn't consider energy resources as a significant factor (Stern, 2004). The economic growth model doesn't include resources at all, as suggested by (Solow, 1956). However, the production and growth theory considers energy resources an intermediary ingredient. On the other hand, the ecological theories of economics and economists consider the necessity for energy as one of the essential and central elements for production and economic progress (Cleveland, 1984). A fair no. of empirical studies have considered the nexus between energy consumption &

economic advancement all across the world. To analyze the linkage between energy consumption and economic progression, empirical evidence from a single country's studies is as follows: The research study took the time series data on the selected variables of Turkey from 1968 to 2005. The variables chosen for the study are energy consumption, employment rate, carbon emissions, and economic progress. The ARDL and Granger causality techniques were employed to see the relationship among these variables. After applying the above methods, the output of analysis illustrates that economic output didn't have causality with energy consumption, whereas employment has a causal association with the economic output (Ozturk & Acaravci 2010) (Shah et al., 2023). The study also selected China as a sample and used the time series data from 1960 to 2007. The study used variables such as energy use, the output of the nation, urban population, and carbon emissions to see the connection among them by applying the multivariate model. Various techniques were used to analyze the data, such as Johansen Co-integration and Granger causality. The results based on these techniques portray that energy use has Uni-directional causality with economic output in the long run (Zhang & Cheng 2009).

Similarly, the study analyzed the linkage between renewable and non-renewable energies and economic progress in Pakistan. Time series data was taken from 1972 to 2011 as a sample size. The test used for data were ARDL and Granger Causality; based on that analysis, the output reveals a linkage between energy consumption and economic output(2012). The study of (Alshehry & Belloumi 2015) was taken in the context of Saudi Arabia by using data from 1971 to 2010 to examine the inter-association among economic activity, energy consumption, and price by employing techniques like multivariate Co-integration and based on this, the VECM model. The analysis depicts a Uni-directional causality between energy consumption and economic output in the long run. To analyze the linkage between energy consumption and economic growth, empirical evidence from multiple countries taken as a context of the research study are as follows: To see the linkage among the CO₂ emissions, coal consumption, and economic growth. Both co-integration technique & VECM were used in the study on China and India, which was taken as a sample. The results demonstrated a causal linkage between coal use, CO₂ emission, and economic progress in China, while the results differed for India. Conversely, this analysis confirmed the Uni-directional relation between CO₂ emissions and economic progression to coal consumption (Govindaraju and Tang. The research study used panel data from 1980 to 2006 in 17 ASIAN countries to study the causality of energy consumption and economic growth.

The results highlighted a long-run equilibrium in the selected sample countries of study. Conversely, in the short and long run, variables such as energy usage and output have shown direct causal associations between them (Chye et al., 2011). The SAARC nations were also used as a study sample from 1970 to 2006. The study used Johansen co-integration and VECM tests to see the connection between energy consumption, electricity consumption, and oil consumption with output.

Figure 1 Conceptual Framework



3 Research Methodology

This study is causal and descriptive; time series data is taken for the variables of interest (FDI, Energy consumption, and GDP (a proxy of economic growth)), and the research method used is quantitative. The secondary data is used from 2000 to 2020. Further, we have checked data stationarity with the help of Unit root Tests. In this, we have used Augmented-Dickey-Fuller (ADF) tests. We have employed the lag selection criteria for optimal lag, the ARDL Bound Test for long-run relationships, and the Wald test for short-run relationships.

On the other hand, we have applied the Histogram test for normality, the Breusch-Pagan-Godfrey test for heteroscedasticity, the Ramsey Set test, and the CUSUM & CUSUM Squares Test for model specification. Secondary data will be used for all three variables. The annual time-series data will be used for Foreign Direct Investments (FDI), energy consumption, and gross domestic product (GDP) from 1982 to 2018. The data is obtained from World Development Indicators (WDI) & State Bank of Pakistan (SBP).

3.1 Data Analysis

Table 1 shows that results of the ADF test suggest that FDI is stationary at a level as t-statistics shows -5.395157. In contrast, Energy consumption is stationary at the first difference as t-statistics shows -3.283140, and GDP is stationary at the second difference as t-statistics shows -4.411301. This also suggests that independent variables are inert at different orders of integration, leading to the use of Granger causality and the ARDL Model.

Table 1 ADF Test

Variable Name	Order	T-statistics	Prob
Foreign Direct Investment	Level	-5.395157	0.0005
Energy Consumption	D1	-3.283140	0.0305
Gross Domestic Product	D2	-4.411301	0.0033

Table 2 lag selection criteria shows the optimal lag for analysis based on this lag selection criteria table. The optimal lag is 4 as suggested by LR sequential modified LR test based on 5% level, Final Prediction Error, Akaike Information Criteria, Schwarz Information Criteria, and Hannan-Quinn Information Criteria. All these criteria suggest that lag 1 is appropriated as auto-selected by the software, indicating minimum lag order in the given time series data.

Table 2 Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	0.075567	NA	0.000283	0.344051	0.491089	0.358667
1	44.22347	67.52033	4.65e-06	-3.790997	-3.202846	-3.732533
2	50.74349	7.670610	7.09e-06	-3.499234	-2.469971	-3.396923
3	65.44209	12.10473	5.22e-06	-4.169657	-2.699281	-4.023499
4	113.8514	22.78084*	1.29e-07*	-8.806043*	-6.894553*	-8.61604*

Tables 3, 4, and 5 of the bound test show that there is a long-run relationship among variables as the F-statistic is greater than the lower and upper value of the bound, i.e., 12.58891, which is significant at all levels, ultimately suggesting the long run relationship among variables as GDP is associated with foreign direct investment and energy consumption. Further, long-run coefficients suggest that both FDI and EC have a significant positive long-run relationship with GDP as both independent variables are significant at 0.0133 & 0.0006 with a T-statistic of 5.268 and 15.294. Also, the constant value shows a

negative sign that suggests a long-term relationship, and the GDP adjustment speed towards equilibrium with FDI and EC is 27%.

Table 3 Bounds Test

Test Statistic	Value	K
F-statistic	12.58891	2

Table 4 Critical Values Bound

Significance	I0	I1
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.36

Table 5 Long Run Coefficients

Variable	Coefficient	Std. Error	T-statistic	Prob
LOGFDI	0.451498	0.085714	5.267514	0.0133
LOGEC	2.638791	0.172540	15.293805	0.0006
C	27211103	3.903721	-6.970555	0.0061

Table 6 shows the short-run relationship among variables combined, and analysis of the Wald test indicates that there is a short-run relationship among variables also because Chi-square has a probability less than 0.05, which indicates that both independent variables, Foreign Direct Investment, and Energy Consumption, also affects Gross Domestic Product of Pakistan, shortly. As Pakistan is a developing country and heavily depends on FDI, almost everything needs energy for production, which benefits the economy.

Table 6 Wald Test

Test Statistic	Value	Df	Probability
F-statistic	415.6619	(13,3)	0.0002
Chi-square	5403.605	13	0.0000

Table 7 of the Breusch-Pagan-Godfrey test is used to analyze the difference between homoscedasticity and heteroscedasticity, and the above tables show that there is homoscedasticity in residuals as they do not deviate from the actual mean. As the probability of the Chi-square test is 0.233, which is greater than the threshold of 0.05, the null hypothesis is not rejected. This outcome suggests that the data is appropriate for further analysis.

Table 7 Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-Statistic	5.371464	Prob. F (12,3)	0.0961
Obs*R-Squared	16.29973	Prob. Chi-Square (13)	0.2333
Scaled Explained SS	0.466477	Prob. Chi-Square (13)	1.0000

Table 8 presents the Ramsey Reset Test used to check whether the model is well specified for analysis. The test results based on the above table show that the model is well specified. It has an appropriate functional form as the probability of F-statistic is greater than 0.05 that is 0.7749, indicating that the model is appropriate.

Table No.8 Ramsey Reset Test

Ramsey Test	Values	Df	Probability
t-statistic	0.326687	2	0.7749
F-statistic	0.106724	(1,2)	0.7749

4 Interpretation

Figure 1 shows the results of the normality test. The above normality test results indicate that data is distributed normally as the probability is greater than 0.05, which is 0.928902, indicating that $H_0=0$ failed to reject. Further, the jarque-bera is also close to zero, kurtosis is also close to 3, and skewness is also close to zero. All these points suggest that data is normally distributed.

Figure 2 Normality Test

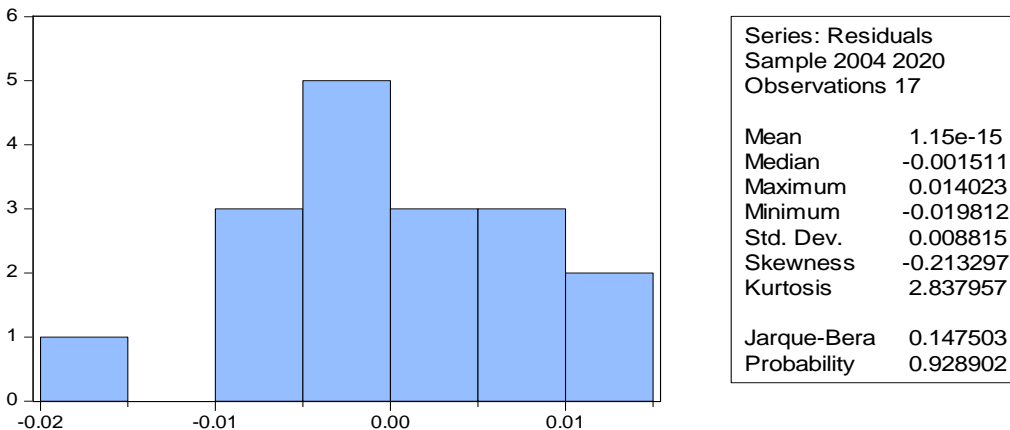
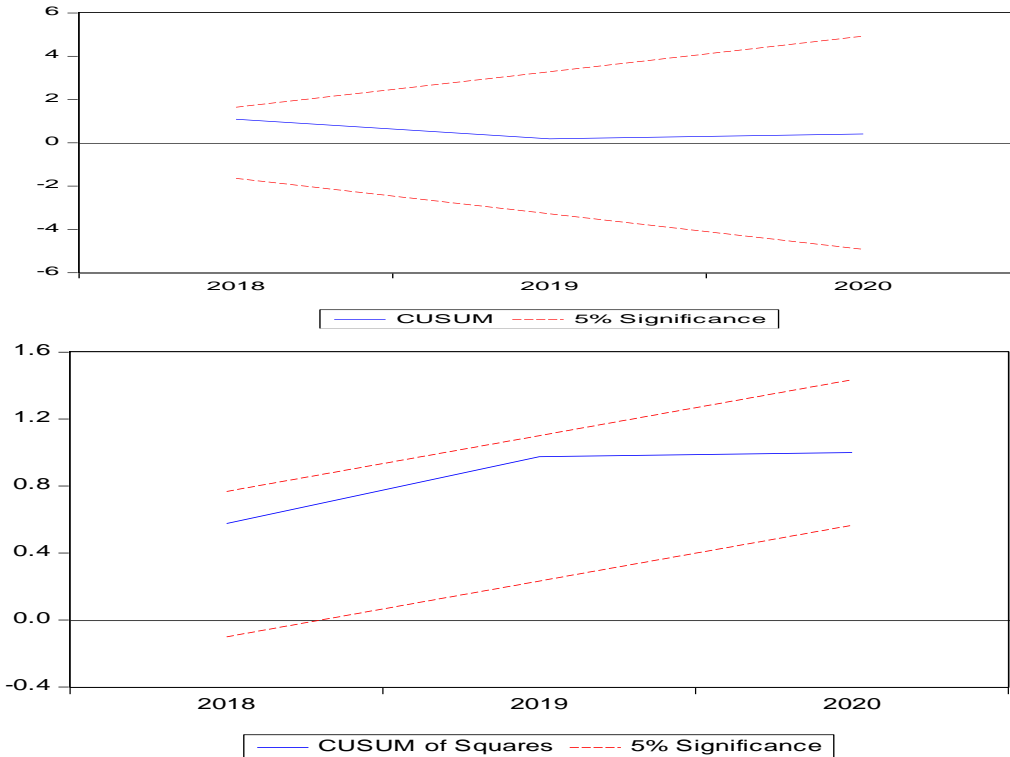


Figure 3 & 3 CUSUM & CUSUM Square Test

4.1 Interpretation

Figure 2 and 3 show the results of CUSUM and CUSUM Squares, which indicated that if blue line lies between red line of 5% critical bound the model is stable. Based on CUSUM and CUSUM Squares results the research model is appropriate and stable for analysis.

5 Conclusion

The present research analyzes short and long associations among variables FDI, EC & EG of Pakistan through the ARDL and Wald model. The data from 2000 to 2020 is taken from WDI & State Bank of Pakistan. Each variable stationary (ADF) technique. The results suggest that two variables are non-stationary at level, and then one is converted to the first order of integration, and one is converted to the second order of integration to have stationary variables. The results showed short-run and long-term association among

variables as GDI is affected by both independent variables in any area. The above results are well supported and consistent with the previous studies conducted by (Shahbaz, 2012), (Gupta, 2016), (Latief and Lefen 2018), (Khatun & Ahamad 2015), (Lee, 2013), (Narayan 2010), and (Lee & Chang 2007) (Shah et al. 2023) to find linkage among energy consumption, FDI and GDP in short run and as well as in long run. The results suggest that Pakistan is an importing country of oil, which is the main component of energy, which directly affects the country's economy in these times of currency depreciation because Pakistan has to pay in dollars, which is one reason for the increasing exchange rate nowadays. On the other hand, Pakistan highly depends on foreign direct investment to overcome development and exchange rate issues, which is why Pakistan is requesting neighbors' countries to invest in Pakistan to increase employment and economy, which is directly and indirectly affected by FDIs.

5.1 Recommendations

Despite being a major recipient of Foreign Direct Investment (FDI), policymakers should prioritize energy sector development to address the significant gap between energy production and consumption in Pakistan. This can be achieved by incentivizing investments in renewable energy sources and promoting energy-efficient technologies. The government should also focus on upgrading the country's energy infrastructure to reduce transmission losses and increase energy availability. Policymakers should formulate policies discouraging loan-based investments to minimize debt and promote sustainable economic growth. Instead, they should encourage foreign investors to bring in equity investments, reducing Pakistan's reliance on debt and mitigating the risk of debt trap. The government should establish clear regulatory frameworks and transparent policies to attract FDI in energy-intensive sectors, ensuring that investments align with national energy priorities. This includes promoting public-private partnerships in energy projects and providing tax incentives for renewable energy investments. Human capital and infrastructure development investments should complement FDI inflows to maximize their impact on economic growth. The government should prioritize education and vocational training programs to develop a skilled workforce capable of absorbing and utilizing advanced technologies introduced by foreign investors. To address energy sector problems effectively, policymakers should consider implementing demand-side management strategies, promoting energy conservation, and encouraging sustainable consumption practices. This includes implementing pricing mechanisms that reflect the actual cost of

energy production and promoting energy-efficient technologies. The State Bank of Pakistan and other relevant authorities should closely monitor FDI inflows and their impact on the energy sector and the overall economy. Regular assessments and evaluations should be conducted to identify areas requiring policy adjustments and ensure that FDI contributes to sustainable economic growth. Lastly, the government should prioritize regional cooperation and explore regional energy trade and cooperation opportunities. This includes collaborating with neighboring countries to develop cross-border energy infrastructure and promoting regional energy security. By implementing these recommendations, Pakistan can effectively harness Foreign Direct Investment to drive sustainable economic growth, address energy sector challenges, and improve overall economic development.

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