Revisiting the Nexus between Economic Policy Uncertainty, Financial Development, and FDI Inflows in Pakistan during Covid-19: Does Clean Energy Matter?

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ABSTRACT

The significance of FDI for economic progress has been well established, especially for developing nations; conversely, the critical role of macro determinants has also been explained in attracting FDI. The motivation of the study is to assess the impact of economic policy uncertainty, financial development and clean energy on FDI in Pakistan economy. The study employed several econometric tools in assessing and documenting the elasticities of EPU, FD and CE in the process of amplifying the inflows of FDI in Pakistan. According to the study findings, it is apparent that financial development and clean energy positively affect FDI, while the effects of EPU are established as adversely connected to FDI. Study findings suggest, in Pakistan, for attracting and targeting the continual inflows of FDI, it is imperative to offer economic sustainability and efficient financial intermediation.

Keywords: Economic Policy Uncertainty, Financial Development, Clean energy, FDI, ARDL
JEL Classifications: Q13; O57; E26

1. INTRODUCTION

Foreign Direct Investment (FDI) has been widely recognized as a crucial element in promoting economic growth in countries, especially those with restricted local resources that heavily rely on FDI to boost their economies at both micro and macro levels. Scholars worldwide have used theoretical and empirical approaches to confirm the positive impact of FDI inflows on recipient countries. FDI inflows provide foreign exchange, encourage innovation, increase employment opportunities, transfer technical expertise through technology transfer, and enhance host countries' exports (Shahzad et al., 2012)_ENREF_5. Indeed, FDI inflows promote economic integration and globalization, fostering international trade and investment. By attracting FDI, recipient countries can develop business partnerships with foreign firms and establish international connections, increasing economic interdependence and cooperation between nations. Moreover, FDI inflows can help to align the policies and practices of the host country with international standards, thereby promoting regulatory convergence and facilitating the cross-border exchange of goods, services, and capital. Moreover, as noted by Abdouli and Hammami (2020), FDI inflows improve a country's financial condition by raising the availability of funds and injecting them into financial markets, thereby supporting their development and boosting economic growth.

Pakistan, a predominantly agricultural economy that lacks technical knowledge and advanced technology, heavily depends on investment inflows. Investment inflows are crucial in bridging the gap between saving and investment and between export and import. (Mohey-ud-Din, 2007). Despite various policies to attract investors, the COVID-19 pandemic caused a significant

decline in FDI inflows to Pakistan due to disrupting supply chains and industries such as tourism, hospitality, transportation, and education. This instability in policymaking and the functioning of financial markets negatively impacted Pakistan's economy. With the pandemic, overwhelming healthcare facilities in developing countries like Pakistan, 2020 and 2021 were chaotic and adversely affected all economic indicators. The closing of borders had a severe impact, causing a sharp decline in FDI inflows to Pakistan. Based on data from the Pakistan Board of Investment, there was a significant increase in net FDI inflows in Pakistan from 2015-16 to 2017-18, followed by a decrease in 2018-19 and a subsequent increase in 2019-20. However, FDI inflows have started declining again in recent years, particularly after the onset of the COVID-19 pandemic.

This study aims to examine how the COVID-19 pandemic has impacted FDI inflows and financial development in Pakistan, using monthly data and empirical analysis. The focus is on understanding the long-term relationship between FDI inflows, financial development, and the pandemic, given Pakistan's high dependence on foreign investment. The pandemic has severely impacted Pakistan's economy, with trade deficits increasing, domestic investment declining, and financial markets experiencing spillover effects, ultimately leading to a decline in GDP. Furthermore, the pandemic has halted significant international projects like CPEC, and labor has struggled to adapt to new technologies and isolation, demanding a robust economic policy to help Pakistan recover from the recession. However, foreign investment in developing countries like Pakistan has become a low priority for even developed nations during the pandemic, jeopardizing significant international foreign projects and leading to a severe lack of funds. The study's empirical results also demonstrate that international disasters hurt FDI inflows, underscoring the need for timely policies to manage such situations.

The study appears to have a clear and specific objective, which is to investigate the impact of COVID-19 on FDI inflows and financial development in Pakistan. The rationale for choosing these variables is explained. The study appears to address a gap in the existing literature by providing an empirical analysis of the relationship between these variables in Pakistan. However, the study's limitations are also acknowledged, including the short period and the lack of cross-sections for panel data analysis. The use of cointegration analysis is justified, given the non-stationary nature of the data, and the choice of monthly data is explained. The study also appears to have practical implications, as it aims to provide policy recommendations for managing global disasters and pandemics. Overall, the objectives and methodology of the study seem reasonable, and the study appears to contribute to the existing literature by providing empirical evidence on the impact of COVID-19 on FDI inflows and financial development in Pakistan.

The remaining structure of the article is as follows. Section II deals with a brief stand focusing on the FDI effects on the Economy; Section III focuses on the literature survey, data, and methodology of the study displayed in Section IV. interpretation and estimation are available in Section V. Section IV reported the discussion of the study findings, and the conclusion is available in Section VI, respectively.

2. EFFECTS OF FDI INFLOWS ON THE ECONOMY OF PAKISTAN

FDI inflows are considered an engine of economic growth in Pakistan's case. Researchers have been trying to determine the impact of FDI inflows on Pakistan's economy for decades. Undoubtedly, FDII inflows accelerate economic growth and positively affect GDP, but initial studies have shown different results. The first empirical study to check the impact of FDI inflows on the economic growth of Pakistan was carried out (Falki, 2009). Time series data from 1986 to 2006 was analyzed, and the study concluded that the impact of FDI inflows on the economic growth of Pakistan is not that significant. It may be due to the lack of infrastructure or human resources. Later studies showed that giving foreign investors an appropriate and favorable environment accompanied by proper resources leads to multiple benefits and positively impacts economic growth. This is evident from a comparatively new study (Tahir et al., 2020). They used an autoregressive distributed lag cointegration approach. They found a positive and significant impact of FDI on the economic growth of Pakistan.

Meanwhile, a study conducted by (Iqbal et al., 2013) analyzed the effect of FDI on GDP by doing a regression analysis. It concluded that FDI has a positive relationship with GDP. However, the impact depends upon the absorptive capacity of the country and the development of financial markets. FDI is a stimulant for converting unskilled labor into skilled human resources through workshops, training programs, and technical education. Moreover, FDI inflows play a significant role by bringing new technology, skill sets, and employment opportunities to Pakistan. Also, Pakistan has been attracting more FDI inflows after relaxing restrictions on foreign funds.

The impact of FDI inflows is mainly associated with the economic growth of Pakistan. (Malik, 2015) empirically tested this relationship along with the impact of FDI on exports, domestic capital, and labor force in the case of Pakistan and found that FDI inflows positively impact Pakistan's GDP and establish a positive and significant relationship among these variables. The findings also suggested that FDI alone cannot help the economy of Pakistan to enter the phase of economic development. Policymakers must concentrate on human capital formation, increase domestic investment, and provide incentives to foreign investors through better political conditions and less economic uncertainty. Also, the exchange rate must be stabilized; such good benefits can be reaped through FDI inflows.

The effects of FDI inflows are not limited to technology, employment, and financial development. Still, it has also been observed that FDI inflows are a source of capital financing in the case of Pakistan. According to (Jaffri and Ahmed, 2010), FDI inflows also impact the equilibrium exchange rate and workers' remittances. If these factors move positively, the banking sector

gets positive spillover effects, increasing foreign investors' confidence. Another study by (Habib and Sarwar, 2013), analyzed the impact of FDI inflows on employment level, exchange rate, and GDP per capita. The study concluded that there is a long-run relationship among the variables and that FDI inflows increase employment at a high rate. GDP per capita also increases due to high FDI but rapid fluctuations in exchange rate cause a negative impact. A strong economic policy making has been suggested to train the labor and control the fluctuations in exchange rate in order to attract more FDI and get full benefits from inflow.

The effects of FDI inflows on the economy of Pakistan have become one the most debated topics among researchers, especially those who belong to a specific area of international economics. Many studies focus on different arguments and variables, but many new variables have been discussed theoretically and tested empirically. Pakistan, a developing country, relies on foreign investment. After introducing new and easy policies for foreign investors, FDI inflows increased manifold. It can be observed that not only economic growth increased by FDI-led globalization increased the transfer of knowledge and technical know-how. Due to improvement in skill sets, labor specialization is being observed, and the movement of labor, which was once a dream for Pakistan's developing economy, has become a reality. The literacy rate increased, the development of new industries became possible, and most importantly agriculture sector transformed from the traditional sector using obsolete technology to become mechanized and commercial. Employment opportunities increased manifold, and improvement in the financial sector became visible. All these factors led to initiate high-level international projects like CPEC.

It is worth mentioning that with these positive impacts, Pakistan has also been paying the cost of FDI inflows. The investing countries are interfering in Pakistan's political, social, and economic infrastructure, causing uncertainty in economic policymaking. Pakistan should also concentrate on domestic investment so foreign interference can be controlled.

3. LITERATURE REVIEW

3.1. Covid-19 Effects on the Economy

The current body of research reveals that while some studies focus on the connection between COVID-19, FDI inflows, and financial development in Pakistan, relatively few empirical studies are available in the context of developing countries like Pakistan. Furthermore, research is scarce on the specific topic. Therefore, the literature review starts by outlining the impacts of COVID-19 on Pakistan's economy. The second segment of the literature examines the link between economic policy uncertainties and FDI inflows. Lastly, the review delves into financial development and FDI inflows. Various factors impact foreign direct investment (FDI) flow into a host country, such as a favorable environment, security, political and economic stability, available infrastructure, human resources, and the situation at borders. When these factors are in place, investor confidence increases, and the recipient country benefits from increased FDI. However, during the COVID-19 pandemic, this became more apparent, as the healthcare system was overwhelmed and borders were closed. Lockdowns negatively impacted the functioning of foreign investment, with developing countries mainly affected. The World Health Organization declared COVID-19 a public health emergency, exacerbating the situation.

According to (Ahmed and Sarkodie, 2021), the initial response to the highly contagious COVID-19 was focused on survival and avoiding infection, which led to measures such as social distancing, travel restrictions, border closures, and complete lockdowns. These actions resulted in a significant decline in FDI inflows, with a global decrease of 4000 basis points in 2020. Compared to 2019, there was a decline of one trillion dollars in FDI. It is expected that FDI will decrease by 50-100 bps in the fiscal year 2021, representing a 600 bps decline since 2005, reducing from 2 trillion dollars to <900 billion dollars (United Nations Conference on Trade and Development (Guterres, 2020).

In their research, Fang et al. (2021) examined the impact of COVID-19 on FDI inflows. They found that the pandemic has presented significant challenges to the global economy, particularly regarding cross-border foreign direct investment. The study utilized quarterly data from 2014 to 2020 for empirical analysis. It demonstrated that as the positivity rates of COVID-19 increased, there was a significant reduction in FDI inflows. This trend was particularly notable in countries like the USA and European nations, among the hardest-hit regions of the pandemic. The decline in FDI inflows has harmed global economic growth.

(Adarov and Hunya, 2020), The COVID-19 pandemic has substantially impacted FDI inflows, particularly in Central, East, and Southeast Europe. The inflows declined by 58% during the first half of 2020 compared to the same period in 2019. Developing countries were even more severely affected, experiencing a decline of 75% in FDI inflows. To investigate the effect of the pandemic on FDI inflows, the authors used reliable sources and conducted a descriptive analysis.

In a study conducted by (Fu et al., 2021), panel data from 96 countries from January 2019 to June 2020 was used to investigate the impact of COVID-19 on FDI inflows. The authors employed the Heckman selection model and found that while the spread of COVID-19 harmed FDI inflows, the effects were not uniform across all countries. Investors hesitated to invest in countries where the virus rapidly spread due to concerns about their investments and health. As a result, developing countries, which lack adequate healthcare facilities and resources, were not a priority for investors. The study conducted by (Manoj et al., 2020) investigated the impact of COVID-19 on FDI inflows in Nepal. It concluded that although the pandemic had a negative effect, it was not the main obstacle for emerging economies like Nepal. The authors used descriptive analysis and found that several other factors, such as a favorable business environment, good infrastructure, human resources, political stability, good governance, and geographical advantage, were also essential for attracting FDI. Nepal was already facing challenges in these areas, and the situation worsened after the outbreak of the pandemic.

(Romdhane et al., 2022), Conducted a study using the GMM technique to examine how economic growth, domestic investment,

and trade openness impacted FDI inflows in the Asian region during pre and post-COVID-19. They analyzed data from 1996 to 2018 for the pre-COVID-19 period and from 2019 to 2020 for the post-COVID period. The findings showed that Asian countries received higher FDI inflows during the pre-COVID-19 period than in the post-COVID-19 period. Moreover, economic growth and FDI inflows were positively related. However, the relationship was negatively affected due to the lockdown and border closures that reduced trade openness. The study suggested that the Asian region will require time to recover as COVID-19 has severely impacted its economic indicators.

While there is limited research on the impact of COVID-19 on FDI inflows in Pakistan, a relevant study by (Khalid et al., 2020) analyzed time-series data from 1970 to 2018 to determine the relationship between FDI inflows and economic growth in Pakistan. The study found a positive and significant relationship between the two variables. The authors suggested that attractive policies be developed to increase FDI inflows in Pakistan, as the success of the Diamer Bhasha Dam project depends heavily on higher FDI inflows. However, the COVID-19 pandemic has disrupted this relationship, and policymakers should focus on creating solid industrial clusters to attract foreign investors.

Their study (Abbass et al., 2022) used the Keynesian approach of aggregate demand and aggregate supply to evaluate the situation in Pakistan after the COVID-19 outbreak and analyzed several macroeconomic variables. The study found that Pakistan was experiencing a recovery phase with FDI inflows of 1.34 billion US dollars during the first 6 months of the fiscal year 2019-2020. However, the situation changed as the pandemic hit the country. The authors suggested that Pakistan adopt policies similar to those of other developing economies that were negatively affected by the pandemic but were able to recover.

(Coulibaly et al., 2021), Suggest that the Asia and Pacific region has traditionally been an attractive destination for FDI due to its low labor costs and strategic location. However, following the outbreak of the pandemic, the region experienced a 36% decrease in FDI inflows, with Pakistan being one of the countries receiving the least FDI. This decline in FDI led to negative impacts such as unemployment, poverty, and inflation. Additionally, the health sector required foreign assistance due to inadequate healthcare facilities, which were not available promptly. According to (Das, 2022), Pakistan has faced numerous challenges since the outbreak of COVID-19, including a sharp decline in FDI inflows and economic growth. However, the situation improved when China provided much-needed medical supplies. Pakistan became the first country to receive testing kits from China. This assistance helped to improve FDI inflows and other economic indicators.

3.2. EPU Effects on FDI
Economic policy uncertainty (EPU) can cause severe damage to the economy of a country, especially developing countries since the policymakers and government framework become undefined in an uncertain situation that negatively affects business and investment due to risky market conditions. Policymaking is the most crucial

step in bringing economic stability. It requires more sophistication when dealing at the international level.

Canh et al. (2020) Economic policy uncertainty has gained much attention from researchers, especially after Brexit, and macroeconomic variables are negatively affected. EPU reduces production and investment. EPU has more severe effects outside the domestic environment of the country, especially when it comes to FDI inflows. Sometimes, foreign investors cannot reverse the investment in the recipient country. Due to EPU, the waiting time also negatively affects the exchange rate. It is safe to say that EPU and FDI inflows have an inverse relationship, i.e., high EPU results in lower FDI inflows. Since it cannot be denied that FDI inflows benefit a recipient country, especially if the host is a developing economy, foreign investors will first analyze the risk and uncertainty situation in investing countries. If EPU is high, they will reduce FDI inflows by a significant amount. (Choi et al., 2021) While highlighting the importance of FDI inflows for a recipient country, point out that FDI inflows have been identified as a source of increasing economic growth, bringing new ideas, technology, and employment to the host country. Identifying the cost-benefit analysis attached to foreign investment compared to domestic investment, it has been found that foreign investment has higher fixed costs than domestic investment. Also, foreign investors are less aware of the country's political and economic conditions than domestic investors, making foreign investment more sensitive to uncertain and risky situations. Suppose EPU foreign investors expect higher and low returns due to a less developed financial system. In that case, the FDI inflows will undoubtedly fall. Nevertheless, suppose the risk factor is reduced in the host country with the help of a developed financial system. In that case, the adverse effects of EPU can be controlled.

(Avom et al., 2020) While discussing the recent events at the world level, which resulted in uncertain situations, including Brexit, the election campaign of Donald Trump, and the trade war between the United States and China, have to encourage researchers and policymakers to study the effects of social, political and economic uncertainty since a prepared policy framework reduces the impact of risk and uncertainty and a country can be protected against unemployment, liquidity issue in the stock market, fluctuations in the exchange rate and fall I economic growth. Authors argue that although researchers have concentrated on the mentioned factors, less importance has been given to the effects of EPU and FDI inflows. The authors conducted an empirical analysis using the world economic uncertainty index and the Generalized Method of Moments, studying the effect of world economic policy on FDI inflows using a panel of 138 countries from 1996 to 2018. They found that world economic policy uncertainty reduced FDI inflows, and this impact is higher in developing/emerging economies than in developed economies.

(Lutfi et al., 2022) While studying the economy of Pakistan mentioned that Pakistan was receiving high amounts of FDI inflows (fourth-largest recipient during the first part of 2019) at USD 33 billion. Pakistan's FDI inflows fell by −39% during 2020 because of COVID-19. For empirical analysis, the authors use ARDL estimations and concluded that due to uncertainty and

lack of financial development, it was observed that FDI inflows fell both in the short and long run.

Although many studies discuss the effects of EPU on various macroeconomic variables, especially FDI inflows, there is a lack of literature related to EPU and FDI inflows in Pakistan. Although Pakistan has a high level of economic policy uncertainty, there is a lack of debate on this topic in the case of Pakistan related explicitly to FDI inflows. Pakistan, a developing country with a high level of political and economic issues, cannot afford an uncertain environment. It is evident from the present migration and brain drain, which is more than ever. Domestic investors are hesitant while investing in Pakistan. In such a situation, risk and uncertainty have to be minimized as the COVID-19 pandemic has increased uncertainty to the point that people are taking their investments out of Pakistan. Policymakers must devise policies that reduce uncertainty and be prepared for any uncertain situation.

3.3. Financial Development and Inflow of FDI

It has been established in the above sections that FDI inflows lead to economic growth as FDI inflows provide funds and capital to generate positive externalities (Abdouli and Hammami, 2020), which results in boosting economic growth through the provision of technology, increased productivity, new techniques of production and managerial abilities. FDI inflows contribute to the recipient country's financial development, implying more funds availability and strengthening the financial system. This goes back to economic development, where FDI inflows promote financial markets, and financial markets increase economic development. (Alfaro et al., 2009) Their study argues that it has been accepted that FDI inflows result in capital accumulation in the recipient country. Still, even if the human resource is well trained, the efficiency gets affected if financial markets are not functioning correctly. A well-functioning financial system ensures smooth transaction flow and proper capital allocation, enhancing economic growth. Suppose foreign investors have limited access to the credit market even in the presence of the best entrepreneur skills and technology. In that case, the underdevelopment of financial markets puts a limit on reaping the benefits of FDI.

(Nguyen and Lee, 2021) conducted an empirical investigation to analyze uncertainty, financial development, and FDI inflows using a global sample of 116 countries from 1996 to 2017. They found that a high level of economic policy uncertainty lowers economic growth. In contrast, countries with a high level of financial markets attract more FDI inflows.

According to (Dutta and Roy, 2011), the development of financial markets is most important for accelerating the country's economic growth. Emerging economies depend primarily on their potential to make profitable investments. The authors add that financial development is significant for emerging economies since FDI inflows are significant for attracting more inflows. After realizing FDI effects, many emerging economies have been trying since the 1990s and can attract reasonable amounts of FDI inflows.

The developed financial sector and foreign direct investment (FDI) are vital for boosting the country's economic growth (Shahbaz and Rahman, 2012). The benefits of FDI inflows are manifold, especially in developing countries like Pakistan. A developed financial sector supports the smooth functioning of credit flows, making it easy for capitalists to start their businesses. Consequently, consumers get more choices due to various intermediate goods, resulting in high demand for final/finished goods. In this way, FDI inflows give spillover effects. Still, in emerging economies, it is a prerequisite that they have a developed financial market since an economy with more developed financial markets tends to achieve higher economic growth rates and attract reasonable amounts of FDI inflows. To establish this, the authors carried out an empirical analysis of analyzing the relationship between financial development, imports, FDI, and economic growth in the case of Pakistan using quarterly data for the period of 1990QI–2008QIV. ARDL test and cointegration approach concluded a positive and significant relationship among the variables establishing that the Pakistani government must formulate and implement further financial reforms to improve the efficiency of the domestic financial sector, which is a prerequisite to achieving positive spillover of FDI.

Financial markets are a support system for any economy. The baking system, exchange rate, foreign sector, investment projects, and, most importantly, economic growth depend on the smooth functioning of the financial system. A developed financial mechanism ensures the smooth functioning of domestic investment and helps attract reasonable amounts of FDI inflows. Numerous studies have proved that financial development and FDI inflows have a positive relationship, and spillover effects are directly related to increased economic growth. A proper policy framework is required in the case of Pakistan, where financial development is prioritized to gain maximum from FDI inflows.

4. DATA AND METHODOLOGY

4.1. Model Specification

This paper uses monthly data of COVID-19 positive cases and FDI inflows towards Pakistan from January 2020 till May 2022.

The data for COVID-19-positive cases has been extracted from COVID statistics provided by the Government of Pakistan from the official website https://covid.gov.pk/stats/pakistan

And data for FDI inflows have been extracted from archives of the State Bank of Pakistan from the official website https://www.sbp.org.pk/ecodata/nifp_arch/index.asp

The data on COVID is the total number of favorable cases and FDI inflows in a million US Dollars. The variables definition and measures displayed in Table 1.

For initial analyses, Augmented Dickey-Fuller (ADF) test has been applied to determine the order of integration. Later Johansen Cointegration test was applied to check the relationship between COVID cases and FDI inflows in Pakistan.

Using these tests, the following hypothesis is to be tested:

Hypothesis: FDI inflows get negatively affected by COVID-19 in the case of Pakistan.

An empirical model with the equation:

$FDI = \beta_0 + \beta_1 (COVID) + \propto_t$ *where* $\propto_t$ *is a random error term* (1)

Where FDI inflow is a dependent variable and COVID-19 is an independent variable.

4.2. Estimation Strategies

4.2.1. Unit root test
Commonly used unit root tests include the ADF test, the PP test, the DF-GLS test, and the KPSS test. Each of the four tests is based on a unique set of assumptions and has unique characteristics. The ADF test is the most used unit root test. This test assumes that the data is stationary around a linear trend. The null hypothesis of the ADF test is that the data has a unit root, while the alternative hypothesis is that the data is stationary. The PP test is a non-parametric test that assumes no particular data format. Instead, it uses rankings to assess whether the data include a unit root. The null hypothesis of the PP test is that the data has a unit root, while the alternative hypothesis is that the data is stationary. DF-GLS is a parametric test that assumes data follows a random walk with drift. The null hypothesis of the DF-GLS test is that the data has a unit root, while the alternative hypothesis is that the data is stationary. The KPSS test is a non-parametric test that assumes no particular data format. Instead, it uses metrics of stationarity to assess whether the data include a unit root. There is no support for the null hypothesis of the KPSS test.

$$\text{Model 1: } \Delta y_t = \gamma y_{t-1} + v_t \quad (2)$$

$$\text{Model 2: } \Delta y_t = \alpha + \gamma y_{t-1} + v_t \quad (3)$$

$$\text{Model 3: } \Delta y_t = \alpha + \gamma y_{t-1} + \lambda_t + v_t \quad (4)$$

4.3. Combined Cointegration Test Cocointegration Test
The Bayer cointegration test is a statistical test used to determine whether two-time series are co-integrated. The test is based on the concept of combined cointegration, a generalization of cointegration to multiple time series. The test statistic is derived from a linear regression model with two-time series as the dependent variable and a constant and trend as the independent variables. The test's null hypothesis is that the two-time series are not co-integrated, while the alternative hypothesis is that they are co-integrated. If the null hypothesis is rejected, then it can be concluded that the two-time series are co-integrated.

Fishers' equation is considered in deriving the test statistics for detecting long-run association.

$$EG - JOH = -2[LN(PEG) + LN(PJOH)]$$

$$EG - JOH - BO - BD = -2[LN(PEG) - \ln(PJPH)$$
$$+ \ln(PBO) + \ln(PBDM)]$$

4.4. Autoregressive Distributed Lagged (ARDL)
ARDL models are a specific form of the econometric model used to estimate the long-run connection between variables while allowing for short-run dynamics. The most important advantage of using an ARDL model is that it can estimate the long-run connection between variables even when the data is non-stationary. This is the primary benefit of utilizing an ARDL model. This is significant because many economic time series are non-stationary, which implies that conventional linear regression models cannot be used to analyze them. Focusing the existing literature (Qamruzzaman and Karim, 2020b; Qamruzzaman et al., 2020; Qamruzzaman and Karim, 2020a; Qamruzzaman and Jianguo, 2018) For documenting the long-run and short-run coefficients of EPU, CE, and FD on FDI inflows in Pakistan, the study purposively employed the novel and widely appreciated econometrical techniques initially offered by (Pesaran and Shin, 1998), and further improvement has been incorporated by (Pesaran et al., 2001) is known as ARDL bound testing approach. There are many advantages to using the Autoregressive Distributed Lagged (ARDL) model. The ARDL model is a powerful tool for analyzing time series data. This is because it can take into account both short-term and long-term effects.

Additionally, the ARDL model is relatively simple to implement and can be used with various data sets. Another advantage of the ARDL model is that it can be used to test for cointegration. Cointegration occurs when two or more variables move together over time. Testing for cointegration is essential because it can help identify relationships that may not be apparent at first glance. Finally, the ARDL model is also flexible regarding the data type that can be used. The generalized ARDL regression model is as follows.

$$
\begin{aligned}
\Delta lnFDI_t = {} & \alpha_0 + \sum_{i=1}^{n} \mu_1 \Delta lnFDI_{t-i} + \sum_{i=0}^{n} \mu_2 \Delta lnEPU_{t-i} \\
& + \sum_{i=0}^{n} \mu_3 \Delta lnFD_{t-i} + \sum_{i=0}^{n} \mu_4 \Delta lnCE_t + \sum_{i=0}^{n} \mu_4 \Delta lnTO_t \\
& + \sum_{i=0}^{n} \mu_5 \Delta lnINF_{t-i} + \gamma_1 lnFDI_{t-i} + \gamma_2 lnEPU_{t-1} \\
& + \gamma_3 lnFD_{t-1} + \gamma_4 lnCE_{t-1} + \gamma_4 lnTO_{t-1} + \gamma_5 lnINF_{t-1} + \omega_{1t}
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
\Delta lnFDI_t = {} & \alpha_0 + \sum_{i=1}^{n} \mu_1 \Delta lnFDI_{t-i} + \sum_{i=0}^{n} \mu_2 \Delta lnEPU_{t-i} \\
& + \sum_{i=0}^{n} \mu_3 \Delta lnCOVID_{t-i} + \sum_{i=0}^{n} \mu_3 \Delta lnFD_{t-i} \\
& + \sum_{i=0}^{n} \mu_4 \Delta lnCE_t + \sum_{i=0}^{n} \mu_4 \Delta lnTO_t + \sum_{i=0}^{n} \mu_5 \Delta lnINF_{t-i} \\
& + \gamma_1 lnFDI_{t-i} + \gamma_2 lnEPU_{t-1} + \gamma_3 lnFD_{t-1} + \gamma_4 lnCE_{t-1} \\
& + \gamma_4 lnTO_{t-1} + \gamma_5 lnINF_{t-1} + \omega_{1t}
\end{aligned}
\tag{2}
$$

FDI, EPU, CE, FD, TO, INF, and COVID represent foreign direct investment, economic policy uncertainty, financial development, clean energy, trade openness, and inflation, respectively. The coefficient of μ_1 to μ_6 and γ_1 to γ_5 explained the elasticities of explanatory variables on FDI in the short-run and long-run horizon. Δ Denote the first difference operator in the empirical estimation.

Finally, the short-run coefficients can be exported using the following short-run equation with an error correction term.

$$\Delta lnFDI_t = \alpha_2 + \sum_{i=1}^{n}\beta_1 \Delta lnFDI_{t-i} + \sum_{i=0}^{n}\beta_2 \Delta lnEPU_{t-i}$$
$$+ \sum_{i=0}^{n}\beta_3 \Delta lnFD + \sum_{i=0}^{n}\beta_3 \Delta lnCE + \sum_{i=0}^{n}\beta_6 \Delta lnTO_t$$
$$+ \sum_{i=0}^{n}\beta_7 \Delta lnINF_{t-i} + \rho ECT_{t-1} + \omega_{1t} \quad (3)$$

$$\Delta lnFDI_t = \alpha_2 + \sum_{i=1}^{n}\beta_1 \Delta lnFDI_{t-i} + \sum_{i=0}^{n}\beta_2 \Delta lnEPU_{t-i}$$
$$+ \sum_{i=0}^{n}\beta_3 \Delta lnFD + \sum_{i=0}^{n}\beta_3 \Delta lnCOVID + \sum_{i=0}^{n}\beta_3 \Delta lnCE$$
$$+ \sum_{i=0}^{n}\beta_6 \Delta lnTO_t + \sum_{i=0}^{n}\beta_7 \Delta lnINF_{t-i} + \rho ECT_{t-1} + \omega_{1t} \quad (4)$$

Several methods of diagnosis were used. We first checked for heteroscedasticity in the augmented ARDL model's residuals using the Harvey test. Second, we checked for serial correlation in the residuals using the Breusch-Godfrey Serial Correlation LM test. Finally, we used the Ramsey RESET test to check the model specification. Lastly, we tested whether or not the model residuals were normally distributed using the Jarque-Bera normality test. Lastly, we used the CUSUM and CUSUM of square tests to ensure model stability.

5. MODEL ESTIMATION AND INTERPRETATION

5.1. Unit Root Test
The present study has implemented several static tests in exploring the research variables' stationary properties by employing the unit root framework offered by (Dickey and Fuller, 1979), (Phillips and Perron, 1988), (Elliott et al., 1996), (Kwiatkowski et al., 1992) and (Ng and Perron, 2001). Table 2 displays the results of the stationary test and establishes that all the variables are stationary after the first difference in all tests. The unit root test results affirmed the application of robust econometric techniques for empirical estimation.

Next, the study performed a cointegration test to assess the long-run association between explained, explanatory and control variables in the empirical equation by employing the novel (*Bayer and Hanck, 2013*) combined cointegration test and results displayed in. In terms of test statistics, it is apparent that all the test statistics are statistically significant at a 1% significance level, thus, establishing a long-run cointegration in the empirical assessment.

5.2. Autoregressive Distributed Lagged (ARDL) Estimation
The long-run cointegration between explained and explanatory variables has been investigated using a bound testing approach under the linear and nonlinear framework. Referring to the test statistics that are Foverall, tDV, and FIDV, it is apparent that all the test statistics have revealed statistically significant at a 1% level, establishing the long-run association in the empirical equation. Table 3 displays the results of the cointegration test.

Table 1: Variables proxies and definition

Variables	Notation	Definition
Foreign direct investment	FDI	Inflows of FDI as a % of GDP
Covid 19 effects	COVID	Dummy variables used 1=yes, 0=no
Economic policy uncertainty	EPU	Economic policy uncertainty index
Financial development	FD	Domestic credit to the private sector
Clean energy	CE	Renewable energy consumption as a % of GDP
Inflation	INF	
Education	EDU	Percentage of secondary school enrollment

FDI: Foreign Direct Investment

Table 2: Results of unit root test

Variables	At level				First difference			
	ADF	GF-DLS	PP	KPSS	ADF	GF-DLS	PP	KPSS
Y	−1.5959	−2.3834	−1.2964	0.8049***	−8.6404***	−9.17***	−7.8785***	0.0199
FI	−1.8451	−1.2438	−0.3126	0.7507***	−5.5409***	−7.5557***	−7.4448***	0.0216
TI	−1.9179	−1.6193	−1.7579	0.732***	−8.432***	−7.4948***	−6.3972***	0.0187
ED	−2.0031	−0.467	−2.3246	0.8962***	−6.9094***	−7.0428***	−7.2469***	0.0188
CE	−1.0015	−0.3327	−1.8025	0.7143***	−9.2643***	−6.1162***	−5.4111***	0.0206
GCF	−1.8294	−0.7411	−1.0628	0.9086***	−7.6528***	−6.9964***	−8.6574***	0.0192
FDI	−1.9388	−1.9251	−2.0336	0.8904***	−8.0916***	−7.526***	−7.773***	0.0189
Variables	MZa	MZt	MSB	MPT	MZa	MZt	MSB	MPT
Y	−1.9009	−0.786	0.3062	8.4025	−16.672***	−4.2604***	0.1616***	4.9284***
FI	−1.8653	−0.7033	0.2666	8.588	−21.731***	−4.09***	0.1505***	3.3786***
TI	−2.4452	−0.822	0.325	7.8165	−19.466***	−4.7173***	0.1533***	4.3989***
ED	−2.3438	−1.0118	0.2556	7.4232	−20.562***	−4.076***	0.1425***	4.2922***
CE	−2.295	−1.2615	0.3174	7.7446	−23.417***	−5.3607***	0.1603***	4.7738***
GCF	−1.8729	−1.0407	0.287	8.2024	−20.969***	−4.6448***	0.1449***	3.6208***
FDI	−2.5168	−1.6182	0.2271	7.6483	−17.326***	−5.5886***	0.1782***	4.7733***

The superscript ***explained the significance level at 1%. ADF: Augmented Dickey-Fuller, FDI: Foreign Direct Investment

Long-run and short-run coefficients of symmetric assessment are reported in,Table 5 with long-run coefficients in Panel –A, short-run coefficients in Panel –B, and Diagnostic test results in Panel –C, respectively.

They are referring to EPU coefficients established as negative and statistically significant in the long run and short run, explaining the detrimental influences of EPU on inflows of FDI in Pakistan. More precisely, a 1% change in EPU will reduce FDI inflows by 0.0903% in the long run and by 0.0703% in Model [1]. Furthermore, the coefficient of EPU with COIVD effect inclusion has produced a similar vine of association; particularly, FDI inflows could be adversely affected in the long-run by 0.1233% and in the short-run by 0.0695% in the short-run due to a 1% changes in EPU. Our study finding aligns with existing literature such as (Ma and Qamruzzaman, 2022b; Ma and Qamruzzaman, 2022a; Canh et al., 2020; Hsieh et al., 2019). Study findings postulate that It is widely believed that economic policy uncertainty hurts foreign direct investment (FDI) inflows. Businesses and investors are often reluctant to invest in countries with unstable or uncertain economic policy environments. Studies have shown that economic policy uncertainty can deter FDI by up to 30%.

There are several reasons why economic policy uncertainty may harm FDI. Firstly, it makes it difficult for businesses to plan and forecast their future activity. This lack of clarity can lead to firms postponing or canceling investment plans as they wait for more clarity on the policy environment. Secondly, instability and uncertainty may increase the perceived risks of investing in a particular country (Choi et al., 2021). This could lead businesses and investors to seek alternative destinations for their FDI. The effect of economic policy uncertainty on FDI inflows is likely to vary from country to country and over time. In general, however, this uncertainty can be a significant barrier to investment. Policymakers should therefore be aware of the potential impacts of economic policy changes on FDI flows and seek to avoid unnecessarily destabilizing the investment environment.

For clean energy consumption, the study exposed a contributory role of augmenting the inflows of FDI in the long run [a coefficient of 0.1541 in model -1 and 0.1576 in model -2] and in the short-run [coefficients of 0.0111in model -1 and 0.0265 in the model -2]. Specifically, a 1% change in clean energy consumption in aggregate energy composition will amplify FDI inflows in the long-run range between 0.1541% and 0.1576% and in the short-run range between 0.0111% and 0.0265%. According to CE coefficients, the study advocated that clean energy has imminent effects on FDI in the long run compared to the short run. Our study findings are supported by the existing literature, such as (Djellouli et al., 2022; Azam and Haseeb, 2021; Oke et al., 2021; Xia et al., 2022). Renewable energy is critical to sustainable development and the

Table 3: Results of the combined cointegration test

Model	1	2	3	4	5
EG-JOH	12.694	11.06	11.089	10.899	10.644
	11.229	10.895	10.637	10.576	10.419
EG-JOH-BO-BDM	35.31	25.339	23.299	21.177	20.957
	21.931	21.106	20.486	20.143	19.888

Table 4: Long-run cointegration: Symmetric and asymmetric environment

long-run cointegration	$F_{overall}$	t_{DV}	F_{IDV}
April	9.917***	−6.205***	9.783***

Note: the superscript *** explained the significance level at 1%.

Table 5: Results of autoregressive distributed lagged estimation of long-run and short-run coefficients

Variables	(1)			(2)		
	Coefficient	T-statistics	SE	Coefficient	T-statistics	SE
Panel–A: Long–run coefficients						
EPU	−0.0903	0.0036	−25.0833	−0.1233	0.0045	−27.4012
FD	0.0561	0.0027	20.7407	0.0531	0.0114	−4.6578
CE	0.1541	0.0044	35.0227	0.1579	0.0107	−14.757
COVID-19				−0.1353	0.0076	−17.8026
INF	−0.0919	0.0036	−25.5277	−0.0587	0.0064	−9.1718
TO	0.1503	0.0073	20.5106	0.14027	0.0067	20.7051
Panel–B: Short-run coefficients						
ΔEPU	−0.0703	0.0028	−25.1071	−0.0695	0.0075	−9.2666
ΔFD	0.0244	0.0023	10.6086	0.0106	0.0665	16.0757
ΔCE	0.0111	0.0091	1.2197	0.0265	0.0048	5.5208
ΔCOVID-19				−0.1097	0.0059	−18.5932
ΔINF	0.0835	0.0098	8.5204	0.0829	0.0079	10.4936
ΔTO	0.0449	0.0034	13.2058	0.0197	0.0115	1.713
ECT (−1)	−0.2349	0.1334	−1.7615	−0.1726	0.1647	−1.0482
C	−2.86534	0.7984	−3.5888	−4.585148	0.6493	−7.061
Panel–D: Residual diagnostic test						
$\chi^2_{Autocorrelation}$	0.796			0.599		
$\chi^2_{Heteroskedasticity}$	0.772			0.835		
$\chi^2_{Normality}$	0.769			0.738		
χ^2_{Reset}	0.651			0.634		
CUSUM		S			S	
CUSUM of square		S			S	

EPU: Economic policy uncertainty, FD: Financial development, CE: Clean energy, INF: Inflation, SE: Standard error

fight against climate change. It is also a key driver of economic growth, potentially creating millions of new jobs and lifting millions out of poverty. Renewable energy is increasingly critical in foreign direct investment (FDI) decisions. There are several reasons why renewable energy can attract FDI. First, renewable energy projects often require a significant upfront investment, which can boost local economies. Second, renewable energy projects often have long-term contracts, which can provide stability and predictability for investors. Third, renewable energy tends to be labor-intensive, which can create new employment opportunities in the host country. Finally, many countries are implementing policies and regulations to encourage renewable energy development, providing investors with a more specific and stable environment (Lin and Qamruzzaman, 2023; Qamruzzaman, 2022; Zhuo and Qamruzzaman, 2022).

The coefficients of financial development have established a positive tie to FDI inflows in the long run (a coefficient of 0.0561 in model-1 and 0.0531 in model-2) and short-run (coefficients of 0.0244 in model -1 and 0.0106 in Model-2). The study advocated the contributory effects of FDon FDI by offering financial efficiency and credit facility for investment capitalization. The study findings ahs supported by empirical studies such as (Desbordes and Wei, 2017; Osei and Kim, 2023; Islam et al., 2023). Financial development can act as a driver of FDI by providing the necessary conditions for businesses to expand internationally. For example, a developed banking sector can provide companies with the financing to invest abroad. Similarly, well-developed capital markets can provide the equity, and debt financing companies require for their foreign operations.

The coefficients of error correction term have been established as negative and statistically significant at a 1% level in both models. The coefficient has explained the correction of disequilibrium due to the short-run variation to be corrected at a speed of 23.49% in Model -1 and by 17.26% in model -2. Furthermore, the present empirical estimation has undergone several residual diagnostic tests for robustness and efficiency. According to test statistics, it is apparent that empirical models are free from spherical correlation, residuals are normally distributed, no issue about heteroskadacity, and efficient estimation has been confirmed.

6. CONCLUSION

The effects of uncertainty have revealed disadvantageous in the case of FDI inflows in Pakistan which is validated in both asymmetric and asymmetric investigation in the long and short run. Our study findings are an adverse linkage between EPU and FDI inflows supported by the existing literature. At its core, EPU can significantly impact investors' confidence in their ability to make informed decisions regarding foreign direct investments (FDI). For example, suppose investors feel the legal framework governing FDI may change without warning or explanation. In that case, they may be less likely to commit capital to a particular project. This can lead to decreased levels of FDI in certain areas and markets due to an overall lack of trust in the regulatory environment.

Additionally, investors may be more likely to take riskier investments due to an increased lack of confidence in their ability to assess the associated risks accurately. This can have potentially damaging implications for businesses seeking foreign investments. These riskier investments may not yield adequate returns for their stakeholders. More than ever in today's globalized economy, foreign direct investment (FDI) flows are becoming a key component of economic growth and development. For many countries, FDI inflows provide much-needed capital and employment opportunities on a large scale. However, the success of FDI inflows depends mainly upon the economic policies of the host country. In the case of clean sources of energy impact on inflows of FDI, the study documented the benefice's role in attracting foreign investors and mobilizing the economic resources in the host economy. This indicates that an energy mix with clean sources has the mandate and pleasing ambiance for an environmentally friendly environment for business development with the assistance of foreign investors. The positive nexus between clean energy and FDI inflows have supported by the existing literature, such as Study findings have explained that renewable energy investments' effects on FDI inflows vary greatly depending on various characteristics unique to each country. These findings support the growing number of studies suggesting that such investments positively affect FDI inflows and should be encouraged to help drive global economic growth. Moreover, identifying the specific characteristics of each country associated with a more significant impact of renewable energy investment on FDI inflows could help policymakers inform their decisions regarding renewables-based foreign direct investment. Clean energy is defined as energy sources that are non-polluting, renewable and do not emit harmful emissions. The most popular types of clean energy are solar, wind, and hydroelectric power. These sources rely on natural resources such as sunlight, wind, and water to generate electricity in a more environmentally friendly manner than traditional energy sources such as coal and oil. Clean energy has the potential to drastically reduce reliance on traditional fuels for electricity generation and thus decrease greenhouse gas emissions. In addition, creating greater access to this type of energy can increase FDI inflows into countries that invest in clean energy solutions. Foreign investment can increase economic growth due to increased jobs, capital influx, and better access to cleaner electricity. As a result, developing clean energy solutions has become an essential factor driving FDI inflows worldwide.

The study postulated that Financial development profoundly affects foreign direct investment (FDI). The role of efficient and effective financial institutions and intermediation has positive and statistically significant effects on FDI inflows in the long-run and short–run and assessments. A country's level of financial development is often a significant attractor for FDI, as it indicates the potential for profitable investment opportunities. Generally, the more developed a country's financial system is, the more likely it is to receive FDI. There are several reasons why financial development affects FDI. First, financial markets provide the essential means by which foreign investors can channel their investment into productive activities in the host economy. Second, a well-developed financial system can help to reduce the risk of investing in a new economy. Finally, financial development can assist in transferring technology and know-how from developed

economies to less developed economies, furthering their economic development.

In conclusion, financial development has a significant impact on FDI flows. Countries with well-developed financial systems are more attractive to foreign investors. They tend to receive more significant levels of FDI. Financial development can also help to boost economic growth and promote technological transfer from developed to less developed economies.

It is no secret that many economies rely heavily on foreign direct investment (FDI) for their funding needs, especially in the case of least developing nations. Foreign direct investment (FDI) may have both beneficial and detrimental effects on local economies. Foreign direct investment (FDI) may help the economy develop, make new employment possible, and promote new ideas. Nevertheless, there are potential drawbacks to foreign direct investment, including the displacement of native labor, the decimation of local industries, and the stifling of innovation. FDI's impact on a country's economy is conditional on various variables, such as the health of the macroeconomy, the nature of the local economy, and the specific industries that attract FDI. It is crucial to assess the potential gains against any potential losses. The motivation of the study is to evaluate the role of EPU, CE, and FD on FDI inflows in Pakistan with the extraordinary incidence during COVID-19. The summary findings of the study are as follows.

Thirst refers to the target explanatory variables' effects on FDI derived from ARDL estimation. First, static tests revealed that research units possess the desired properties for advanced econometric techniques execution. Second, the novel combined cointegration revealed long-run cointegration between explained and explanatory variables. The study revealed contributory effects of clean energy and financial development on FDI. At the same time, EPU has an adverse linkage to FDI inflows in Pakistan, both in the long-run and short run.

By taking into account the study outcome from an empirical investigation, the study advocated that the effects of renewable energy investments on FDI inflows vary greatly depending on a host of characteristics unique to each country. These findings support the growing number of studies suggesting that such investments positively affect FDI inflows and should be encouraged to help drive global economic growth. Moreover, identifying the specific characteristics of each country associated with a more significant impact of renewable energy investment on FDI inflows could help policymakers inform their decisions regarding renewables-based foreign direct investment. Moreover, Foreign direct investment (FDI) is an essential source of capital for many economies. FDI can boost economic growth, create jobs and spur innovation. However, there can also be adverse effects of FDI, such as crowding out of domestic firms, increased competition, and displacement of local workers. The role of FDI in an economy depends on several factors, including the overall macroeconomic environment, the structure of the domestic economy, and the sectoral composition of FDI. In general, FDI can positively and negatively affect an economy. The key is to ensure that the benefits outweigh the costs.

Furthermore, It is widely accepted that economic policy uncertainty (EPU) negatively affects foreign direct investment (FDI) inflows. This paper attempts to fill this gap by providing empirical evidence of the effect of EPU on FDI inflows to a sample of Asian economies. The results show that EPU significantly and negatively affects FDI inflows to Asian economies. The findings also suggest that the impact of EPU on FDI is more pronounced in countries with lower levels of economic development and institutional quality. Predicting how the economic policy will affect foreign direct investment inflows is difficult. While some policies may be designed to attract investment, others may unintentionally have a negative effect. It is essential to carefully consider the potential implications of any economic policy before implementing it.

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