

Financial Liberalization and CO2 Emissions: Evidence from Pakistan

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Abstract

Pakistan is amongst those developing economies which are mostly affected by the climate changes due high level of CO2 emission. The high level of CO2 emission is attributed to industrial activities and liberalization of financial policies for the attainment of economic goals. So keeping in view the disastrous environmental consequences, we investigate the cointegrating relationship among financial liberalization, economic growth and CO2 emission via time series data from 1980 to 2014 in Pakistan. We considered seven proxies such as exchange rates, trade openness, foreign direct investment, money supply, deposit rate, lending rate and foreign portfolio investment for construction of financial liberalization index through principal component analysis whereas, the economic growth is estimated through GDP per capita. The results of Johansen test of Co-integration verified the existence of cointegrating relationship among financial liberalization, economic growth and CO2 emission. Furthermore, VECM depicts short term causal relationship between economic growth and carbon emission.

Keywords: Financial Liberalization, Carbon Dioxide Emission, Johansen Co-integration, VECM.

1. Introduction

The concern of Carbon Dioxide emission in the atmosphere has dramatically increased since 1958 (Neftel, Moor, 1985). This upward trend in the level of CO2 emission has raised so many questions about its impact on atmosphere. One of the main reasons of increasing CO2 emission is the combustion of fossil fuel (Chang & Li, 2019). Carbon dioxide emission is considered as the gas which is highly emitted among other greenhouse gas emission. Approximately about 58% of CO2 is emitted annually out of total greenhouse gas emission of the world (Shahzad, Kumar, Zakaria, & Hurr, 2017), and this percentage is increasing annually. Pakistan has no exceptions in case of carbon emission; gradually shifting from being an agricultural growth economy to

industrial growth raises the demands of energy which further stimulates carbon dioxide emission, which has dreadful impacts on the environment. As argued by (Cheema, 2015) the heat wave in Karachi in 2015 caused more than 1200 deaths and floods in other parts of the country left people homeless. Pakistan is among the top ten countries, which affected the most due to climate change and the reason behind that are the weak environmental laws. The financial sector of Pakistan demonstrates promising indications of supporting development and the country's smart equity markets is ranked amongst the top performing markets of the world by the Bloomberg. Increasing financial development spurs economic growth but further aggravates CO₂ emissions. It is noted that Liberalization policies often tend to increase economic growth (Munir et al. 2013) but it has adverse impacts on climate change by increasing CO₂ emissions because ease of capital availability encourages investment opportunities or even expanding production process which further raises energy demands, that in turn spurs carbon emission. Economic development of a country should not be at the expense of environmental deterioration; rather sustainability should be maintained (Azam, Khan, Abdullah, & Qureshi, 2016). Financial Liberalization endorsed by the advanced countries, since the 1970s and afterwards copied by underdeveloped economies in the late 1990s, was established in the first theoretical base of (Mckinnon, 1973) and (Shaw, 1973). "Financial Repression" of Mckinnon and Shaw provided new ways of thinking in 1970's and 1980's and has great impact on the policies of World bank and IMF. They argue that handling the control of interest rates and allowing banks to increase it would encourage savings. Moreover, with the assumption of a strong response of savings to the rate of interest, higher interest rates are expected to increase financial intermediation, which ultimately stimulate economic development through investment.

Trade is an important factor for economic development but also affects the environment in term of CO₂ emissions. S, Zhang (2018) checked that increase in trade can also raise CO₂ level. Shahzad et al. (2017) identified that trade openness has three types of effects on the environment; Technology effect, composition effect and scale effect. FDI inflows remains one of the major source of external financing in developing countries (Antweiler, Copeland, & Taylor, 2001) because developing countries are attractive for some multinational companies to start their most profitable businesses by shifting their polluting technologies due to feeble government policies and high unemployment rate. This can raised carbon dioxide emission level. Exchange rates fluctuation aggravates CO₂ emissions because of Production growth. Money supply has an association with carbon dioxide emission. When supply of money increases it creates investment opportunities which causes carbon dioxide emission. Low deposit rate and low lending rates encourages industrialization which further elevates CO₂ emissions. FPI is a source of increasing production process which ultimately spurs CO₂ emission level.

The current study contributes to the literature in a unique way. The notable studies such as, Kayani (2020), Gokmenoglu (2019) and Jiang and Ma (2019) among many others have established the financial development and carbon emission nexus. However, the role of financial liberalization has largely been unexplored. Therefore, this study covers the gap in extant literature in the context of Pakistan by empirically investigating the relationship between financial liberalization and carbon emission with an array of advanced econometric techniques for data analysis.

2. Literature Review

4.1.1 Economic Growth and CO2 Emission

The nexus between economic growth and CO₂ emission is empirically examined by most of the researchers because economic activities further aggravate CO₂ emission due to the burning of fossil fuel (Chang & Li, 2018). Rise in manufacturing process exceeds electricity demand and that can be fulfilled by the combustion of fuel. Pakistan currently has an electricity shortfall and to cater this problem Pakistan produces electricity through oil, gas and coal. It means that when electricity demand raises it also triggers carbon dioxide (CO₂) emission. Pakistan has imported 23.97 percent of fuel to fulfill its need in 2017; a major part of this fuel was used for the production of electricity to fulfill electricity demands of the country which causes carbon emission. Pakistan is producing 64.94 % of energy from oil, gas and coal. Some studies further identify the economic growth and CO₂ nexus. Studies like Shaheen, Sheng, Arshad, Salam, and Hafeez (2020) applied ARDL for the period of 1972 to 2014 to examine whether urbanization, GDP, Energy usage influence CO₂ or not. The finding indicates that GDP and Energy usage triggers CO₂ in the long run. Khan, Khan, and Rehan (2020) examined the linkages amongst economic development, electricity usage and CO₂ emission by using ARDL for the period of 1965 – 2015. The result finds that economic development and electricity usage stimulate carbon emission, both in long and short run.

Similarly, Shahbaz, Haouas, Sohag, and Ozturk (2020) by using Energy usage, Economic Globalization and Economic Development to explore the nexus between Financial Development and Environmental Deterioration from Q1 of 1975 to Q4 of 2014 in UAE. The Toda-Yamamoto causality test is employed to examine the causal linkages among variables. Result indicates Financial Development triggers carbon emission. Economic Development stimulate carbon emission whereas, economic globalization mitigates the carbon emission. Result further identifies that Energy usage enhance environmental quality. Awodumi and Adewuyi (2020) by applying NARDL, the study figure out the contributions of non- renewable energy in CO₂ and Economic Development for top countries in Africa in term of Oil production for the period of 1980 to 2015. Result identifies the asymmetric effect of per capita usage of both natural gas and petroleum on CO₂ and economic development for all selected African countries except Algeria. In Gabon, rise in the usage of these energy products raise environmental quality as well as boost the economy. In case of Nigeria, it mitigates the CO₂ emission. However for Angola, positive change in non-renewable energy usage spurs economy but has a combined effect of CO₂ emission.

Ibrahiem (2020) investigated the linkage among technological advancement, economic growth, alternative energy resources, and financial growth in Egypt, from 1971 to 2014. The study uses ARDL, FMOLS, DOLS and Toda- Yamamoto and the result identifies the association amongst the variables. Economic Development and Financial Growth causes environmental degradation whereas Alternative energy and technological innovation enhance the environmental quality. Furthermore, the Toda- Yamamoto identifies a bi-directional causal association between environmental deterioration and economic development.

4.1.2 Financial Liberalization and CO2 Emission

2.2.1. Exchange Rate and CO2

There is a significantly important association between exchange rates volatility and CO₂ emissions (Y. Zhang 2018). Although this relationship is not direct but increasing and decreasing the value of currency has a relationship with production process and ultimately production process leads to increase or decrease carbon dioxide emission because of electricity usage. This

study discusses two different scenarios while decreasing the value of currency against dollar. Firstly, after devaluation of currency, industries related to production process needs to pay more amount of money in order to buy raw materials and it is therefore difficult to change the pricing strategy because the main objective of an organization is to maximize profit with efficient cost and quality of product. When the value of currency decreases then the price of the products increases, thus the purchasing power of local customers also decline. As soon as the purchasing power declines, it stops organization to further produce products which ultimately decrease the demand of energy. It has a negative impact on economic growth of a country (Dimitris, 2006) as well as reduces CO₂emission. Secondly, an important factor which increases the production and that is when there is devaluation of currency it allows foreigners to buy products from the host country at cheaper rates making them more competitive in international market; it increases trade because of rise in production process but it also spurs CO₂ level (Y. Zhang 2018). In this scenario, the devaluation of currency has a positive impact of economic growth (Rodrik, 2008) which further stimulates CO₂emission.

In case of Pakistan where dollar rates fluctuate and rise in the price of dollars causes fall in industrial growth. Y, Zhang (2018) figure out the factors influencing carbon emission and methods for reducing carbon emissions from three perspectives i.e. Energy Consumption, Industry perspective, export oriented economy. Lowering of energy demand at industrial level reduces the production of electricity from fuel which ultimately helps in reducing the carbon dioxide emission. Some studies helps in this regards like Y. Zhang (2018) explored the effect of Exchange Rate, GDP, FDI, Trade Structure on China's CO₂ emission for the period of 1982 to 2016. Result certifies that EKC is valid, while the effects of Services Trade and Exchange Rate on China CO₂ were negative and Foreign Direct Investment Inflows were positive. Similarly several other studies describe how Exchange Rates affect International Trade, Economic Development and Investments. For instance, Victor, Kizito, & Chinonye (2019) explored the influence of Exchange Rate variations in Oil and non Oil Sectors from 1981 - 2016. Findings indicate that there is no linkages of Exchange Rates on non Oil Sector while significant relationship with Oils Sectors. Mohapatra (2019) analyzed the relationship amongst Exchange Rate Exposure and Firm efficiency during 2000 to 2013 for 232 Industries from different Sector. Result reveals that negative association among Exchange Rate exposure and Firm efficiency. Osho and Efuntade (2019) identified the impact of Exchange Rate of Financial Performance Multinational Companies. Outcomes indicate that Exchange Rate variations has vital role in the performance of these companies.

Aman, Ullah, and Khan (2017) conducted a research to investigate the correlation between Exchange Rates and Economic Development in Pakistan from 1976 till 2010, by employing 2SLS and 3SLS Technique. Result shows Positive linkages of Exchange rate with Economic Development, by increasing FDI Inflows, increasing the volume of investment; boosting import substitute industry and export boost incentives. However, Chen (2017) conducted a research to investigate how exchange rate undervaluation influence R & D activities for 49 developed and emerging economies from 1996 to 2011. Result indicates that the undervaluation of exchange rates mitigates the R & D activity for developed and emerging economies, particularly for developed economies.

2.2.2. Trade Openness and CO₂

Trade is considered as a prime ingredient in economic development of a country because it helps in increasing production process, which further leads to rise in carbon emissions (Ansari, Haider

[& Khan, 2020](#)) When imports of any country increases it means that particular country is lacking of producing certain type of products or there might be other reasons for not producing these products like lack of availability of raw material for that particular product or may be lack of energy resources for producing that product. There is still a chance that the country is not utilizing its resources due to lack of technological advancement and technical staff for production process. Imports related to technology which increases energy consumption mainly causes Carbon emission because technology is mainly used for production process and it increases the demands of electricity which is usually fulfilled by combustion of fuel. In case of Pakistan, after to the arrival of CPEC project and moving towards maturity, where overall increase in imports but machinery related to textile, air craft ships, boats and agriculture has increased, during July-February for the financial year 2018 over the same period last fiscal year petroleum products also increases for the same period said above. However, when exports of a country increase its impact on economy is positive, therefore it also increases carbon emission. Because increase in export of a particular country means that they have sufficient industries, they are efficient in using scarce resources, familiar with technology and access of labor at cheap rate. But there is a problem when exports increases it also increases production process which causes rise in electricity demand.

Some studies like [Wasti and Zaidi \(2020\)](#) examined the relationship among Trade Liberalization, Carbon Emission, GDP and Energy Usage in Kuwait, through 1971 till 2017, by employing ARDL. The result indicates along run and short run linkages among variables. Furthermore, Granger causality identified a unidirectional causality from GDP to CO₂ and Energy Usage to Trade whereas a bi-directional causality between CO₂ Emission and Electricity Usage. [Lv and Xu \(2019\)](#) by applying pooled mean group they explored the contrary impact of Urbanization and Openness in Trade on Carbon Emission for 55 Middle Income economies during 1992 to 2012. Results suggested that Openness in Trade has amiable impact on short run, but in long run it has a harmful impact. It also identifies the negative and relationship of Urbanization on CO₂Emission in both Long and Short run. Similarly, [Menon \(2019\)](#)checked the influence of Financial Growth, Openness in Trade, and Electricity Usage on CO₂ Emission. Data from of 1971–2014 is collected and ARDL Bound Test is employed. The outcomes identifying the U-Shape association amongst CO₂ Emission and Electricity Usage in Long run with maximum Threshold of Per Capita 757 KG of Oil Equivalent. [Afridi et al. \(2019\)](#)attempted to investigate the effects of Urbanization, Energy Usage, Per Capita Income and Openness in Trade on Carbon Emission for SAARC Countries during 1980 – 2016, by using Panel Data Techniques. Result suggested that Openness in Trade has negative but Urbanization and Energy Usage has Positive association. Moreover, [Mahmood et al. \(2019\)](#)explored the asymmetrical impact of Trade on Carbon Emission and EKC for the period of 1971 to 2014. Result identified the mixture order of Integration. Volatility in Openness in Trade is positive and Insignificant on Carbon Dioxide Emission.

[Dhiab and Dkhili \(2019\)](#)studied the linkages of trade, financial development, income and urbanization towards CO₂ emission for GCC economies from 1995 to 2016. Granger causality and VECM is used for this purpose. The outcome identifies significant long run positive linkage among variables. Result also reveals that higher level of urbanization and income accelerates CO₂ level; meanwhile financial development spurs carbon emission. Finally Openness in trade mitigates carbon emission. [S. Zhang \(2018\)](#) examined the relationship among share of NON-Fossil energy usage, Openness in Trade, CO₂ Emission, and Per Capita Real Output, with period of 1971 to 2013 for South Korea by using ADRL test. Result identifies that both in Long and Short run boost in NON-Fossil Electricity Usage can reduce environmental deterioration, whereas

rise in trade can further cause Carbon Dioxide Emissions. [Shahbaz, Nasreen \(2017\)](#) investigated the linkages among Openness in Trade and carbon dioxide emission for 3 groups of 105 High Income, Middle Income and Low Income economies by applying Panel Co-integration Test. Result identifies the co-integration of three variables in long run. Openness in trade interfere Environmental Quality for all three panel but their effects varies in these diversified group.

2.2.3. Foreign Direct Investment and CO2

Foreign direct investment is the major source of increasing investment as well as the transfer of technology. Researchers identify two main hypothesizes when FDI inflows affect environment; Pollution halo hypothesis and pollution haven hypothesis. Pollution haven hypothesis refers when industries transfer their most polluted technologies to the host developing countries because of weak environmental laws, cheap labor and raw material to generate healthy revenue. Whereas Pollution halo hypothesis defines that FDI inflows mitigate the environmental degradation by transferring the green technology, which is not only providing employment opportunities but also improves environmental quality by reducing carbon emission.

There are so many factors which help increasing FDI inflows, those factors are Infrastructure, tax structure, and wages and most importantly Political Stability. Pakistan is full of natural resources, Professional and talented people, and accessibility of raw material and tremendous things that are required for Foreign Direct Investment is there, however the political structure is not good as well as Pakistan is fighting against terrorism and in these circumstances it is not easy for anyone one to come and invest in Pakistan. Currently Pakistan is struggling to come out of these circumstances, and CPEC project is a breakthrough in this regard, where opportunities for investment in Pakistan from all over the world increases, which eventually helps in achieving economic goals. But there is another problem, when FDI inflows increase in Pakistan it also triggers the level of carbon dioxide emission which occurs due to a rise in the production process. Studies like [Essandoh, Islam, and Kakinaka \(2020\)](#) applied PMG-ARDL model to study the relevance amongst FDI, CO2 and Trade for 52 economies for the period of 1991 till 2014. Result shows a negative long run association of CO2 and trade for developed economies and a positive long run association with FDI inflows for developing economies. [Dhrifi, Jaziri, and Alnahdi \(2020\)](#) examined the causal linkages amongst CO2, poverty and FDI for 98 emerging economies from 1995 to 2017. Result indicates bi-directional causal linkages between FDI and poverty, carbon emission and poverty, and a unidirectional causal linkage between FDI and CO2. Result further indicates a significant negative linkage FDI and poverty for all selected economies except African panel.

[Bildirici and Gokmenoglu \(2020\)](#) applied ANOVA, Long run estimator, Panel Cointegration and panel trivariate test to check the association among FDI, Economic Development, Terrorism, Environmental Pollution, and Electricity Usage for Pakistan, Syria, Thailand, Afghanistan, Nigeria, Somalia, Yemen, Iraq, Philippines, from 1975 to 2017. Findings of ANOVA reveal the homogeneity between selected economies. Long run estimator indicates a significant influence of FDI, Economic Development, Terrorism, and Electricity Usage on Environmental degradation. [Nasir, Huynh, and Tram \(2019\)](#) investigate the impact of FDI, Financial Growth, and Economic Development for ASEAN-5 economies from 1982 to 2014. DOLS and FMOLS are employed for this purpose and the result reveals that Economic Development, FDI as well as Financial Growth have a long run association with Carbon Emission. It also indicates that these variables further stimulate CO2 emissions.

Similarly, [Imran et al. \(2019\)](#) explored the Short and Long run effect of FDI, Economic Development, and Fossil Fuels Usage, on CO₂ Emissions in 15 Emerging Asian economies, by using Panel Data from 1990 to 2013, by applying ARDL model. Result shows that the attempts to achieve economic growth are contributing greatly to increase carbon dioxide emission. Furthermore FDI has a major role in environment deterioration, causing an increase in carbon dioxide emissions. However, [Shao \(2018\)](#) identified relationship amongst FDI and Carbon intensity from 1990 to 2013 for 188 countries using panel data. For Endogeneity problem Dynamic Panel data is used, and GMM to examine the influence of FDI on CO₂ Emission. Outcome of the study indicates FDI has a significantly negative relationship with CO₂. [Adebola, Solarin \(2018\)](#) explored the effect of FDI on CO₂, Ecological Footprint and Carbon Footprint, by employing Augmented Mean Group Estimator, for 20 economies. Outcomes suggested that there is no Impact of FDI on Environmental Deterioration however, Electricity Usage, Urbanization and GDP causes Pollution. [Phuong \(2018\)](#) examines the causal linkages amongst Foreign Investment, Economic Development and CO₂ Emission from 1986 to 2015. Findings suggested the Inverse U-shape between Environmental Deterioration and Per Capita Income.

2.2.4. Money Supply and CO₂

Money supply positively associated with Economic Development ([Ogunmuyiwa & Ekone, 2010](#)) because of its major role in currency devaluation and revaluation. Interest rate plays a significant role in rise and fall in Money Supply. When the interest rate is high it allows peoples towards saving to get profit, whereas, Low interest rate increases money supply which encourages investment opportunities. Rise in supply of money is positively associated with carbon emission because it enhances investment opportunities, but also triggers CO₂ emissions. Increasing in money supply can cause inflation ([Sultana et al. 2019](#)). The main factor that causes inflation is the rise in the supply of money, which is faster than the growth. On the other hand, if supply of money increases with an increase of growth, than the price of product will not change. Role of state bank is important for controlling money supply ([Ofori, Danquah, & Zhang, 2017](#)).

This study did find the literature which explores the association of Money Supply and Economic Development, and that Development stimulates Carbon Dioxide emission. Some literatures in this regards help this study to analyze that how this money supply will be a source of increasing Economic Development, that further leads to increase in carbon dioxide emission, like [M.S. Khan \(2019\)](#) investigated the effect of Supply of Money on Inflation and Economic Development, employing Johansen Cointegration Test and VECM. Result indicates the association between variables. Granger Causality indicates rise in Supply of Money spur Economic Development. Result also indicates a unidirectional relationship between Economic Development suggested.

[Hussain and Zafar \(2018\)](#) investigated the relationship amongst Inflation, Economic Development, Supply of Money and Government Spending for the period of 1972-2015, employing Auto Regressive Distributed Lags and E.C.M. Finding Indicates Long run relationship amongst Economic Development, Inflation and Government Spending. Furthermore, [Ofori, Danquah, & Zhang \(2017\)](#) figure out the effects of Money Supply on Inflation in Ghana from 1967 to 2015, by using OLS technique. Result indicates long run positive linkages between Money Supply and Inflation.

Moreover, [Chi, Jiao, Xiaolin \(2016\)](#) explored linkages among Money Supply Growth and Inflation for China. The study uses Bootstrap granger full-sample causality test and Sub Sample Rolling Window estimation test to know either these linkages supports quantity theory of money. Result shows a unidirectional relation from Inflation to Money Supply Growth. Similarly,

Chaitip, Chokethaworn, Chaiboonsri (2015) investigated a vast picture on linkages among Money Supply and Economic Development-wide phenomena of AEC open regions, includes Singapore, Malaysia, Thailand, Philippines, Cambodia, LAO PDR, Vietnam, Indonesia. Variables are Economic Development, Money Growth, and Demand Deposits during 1995-2013. Panel unit root and estimation by using Auto regressive log distribution of mean pooled group estimator were employed to know the association. Result indicates that money supply has an affiliation with Economic Development.

2.2.5. Deposit Rate and CO2

The association of deposit rate and economic growth is positive (Munir et al. 2013). It means that when there is a high deposit rate it increases saving. The basic reason behind increasing deposit rate is to decrease inflation; these are government interventions which help to control the inflation. Now when there is an increase in deposit rate, investors move from investment to savings due to high return. In a particular scenario, when deposit rate is high, the cost of production has also gone up because of high Interest Rate against Loans. High Deposit rate is negatively correlated with Carbon Dioxide Emission. However low deposit rates are positively correlated with carbon dioxide emission because of rise in investment opportunities. Copeland, Hall, and Maccini (2019) explored the influence of Interest Rate variations on the Supply and Demand of new light vehicles in an Environment. A 100 basis point rise in both Interest Rates causes a decline in annual growth rates of production from 1.0% to -11.0% and decline in sales from 1.0% to 2.9% in short run. Monthly data starts in February 1972 to December 2011. Munir, et al. (2013) explored the association between Financial Liberalization and Economic Development in Pakistan. Annual time series data from 1972 to 2010 is used. Johansen cointegration is employed for cointegration, while VECM check the short term relationship of variables. Finding reveals a positive linkage among Financial Liberalization, Deposit Rates has a positive, while Lending rate has a negative impact on Economic Development.

2.2.6. Lending Rate and CO2

Low lending rate can lead to increase in industrial development which further aggravates carbon dioxide emission. When lending rate decreases it means that it is easy for industries to get loans from bank which helps to increasing production process which leads to rise in carbon dioxide emission level. High lending rate is negatively associated with economic growth (Munir et al. 2013) because it is not easy for industries to get loan at high rate. When an organization gets loan at high rate it creates difficulties as the production is costly, which ultimately have a negative impact on society as well as mitigates carbon emission.

Some previous literatures which helps to analyze the relationship like Rehman, Nower, Tushar, Abbas, and Musa (2019) Established a linkages among the Monetary Policy and different Economic Factors that radiate toward Development for the period of 1997 to 2017. Economic variables that affect GDP such as Lending rate, Export Import Growth rate, FDI, Borrowing Rate, Employment Rate, Broad Money, and Inflation Rate were used. Result finds that investment, consumption, Government Net Expenditure and Net Export affect the Growth. Similarly, Mansour, Sghaier, Bannour, and Ben Jabeur (2019) analyzed the impact of Financial Crises on the interaction among Deposit Rate, Money Market and Lending Rate. Result indicates an interdependence of Banks' decisions on Deposit Rates and Lending Rates.

2.2.7. Foreign Portfolio Investment and CO2

Foreign portfolio is one of the main components of increasing private investment in a country. It has a major influence in boosting a country's economy because capital inflows increases the

foreign reserves of a country (Chaudhry et al., 2014), and eventually the economy of a country also on its right track because of increase in production process. As soon there is an increase in production it also increases in Carbon dioxide emission by of increase in energy demands. There are many factors involve which helps in increasing foreign portfolio investment which includes, economic performance, political stability, well organized tax system and most importantly the government action against terrorism, because terrorism is the main culprit that affect foreign investment in any country. Several studies explores the linkages of FPI with Economic Development like, Makoni and Marozva (2018) analyzed the relationship among FPI and Financial Market Development, as a macro-economic strategy by Mauritius for the period of 1989 to 2016 by applying ARDL, VECM and granger causality to assess these relationships. Result finds that co-integrating relationship exists between FPI and FDI, FMD and real economic growth. VECM further confirmed that the existence of long run relationship among variables. Whereas Granger causality result confirms that FMD causes both FDI and FPI, while FPI causes FDI.

Okafor, Ugochukwu, & Chijindu (2016) examined association between foreign capital inflows and economic development in Nigeria. The FPI, foreign aid, and FDI are the proxies of foreign capital inflows. Data is collected from 1981 to 2014. To analyze the association between variables, the study employs Toda Yamamoto test of causality. Outcome identifies a unidirectional causality between FPI and GDP, and there is bi-directional causality from GDP to FDI and FDI to GDP. Similarly, Haider, Khan, and Abdulahi (2016) investigated the economic factors that attract investors to invest in the host country. Data is collected from World Bank, from 1997 to 2014 in annual series. Result reveals that External debt and GDP are the main determinants of FPI whereas the population and exchange rates shows that these variables have a strong influence on FPI.

However, Waqas et al. (2015) figure out the linkages among macroeconomic determinants and FPI in South Asian Countries namely Pakistan, China India, Sri Lanka. Data is collected from 2000 to 2012, on monthly basis. GARCH (1, 1) is used for measuring volatility. Result identifies the existence of a significant association between macroeconomic determinants and FPI volatility. Albulescu (2015) explored the influence of FPI and FDI on economic development in 13 CEE economies. Data in collected for the period of 2005 to 2012, by using GMM approach. Control variables such as unemployment rate, CPI inflation, money in circulation, energy consumption, exchange rate, level of education and interest rate. Result indicates a positive relationship of FPI and FDI on economic development. Similarly, Ahmad, Yang, and Draz (2015) explored the causal association of FPI and Economic Development for Indian & Chinese economy. The study uses granger causality for the period of 2001 till 2013. Result reveals no direct association between variables however an indirect association is exists between FPI and Economic Growth for both economies. Chaudhry et al. (2014) analyzed the factor affecting Foreign Portfolio Investment in Pakistan for the period of 1981 to 2012 by using time series annual data. Autoregressive model of partial adjustment with least square is used. Finding indicates that FDI has a negative; however, all other variables have a positive linkage with NPI. Duasa and Kassim (2009) Uses FPI and economic performance of Malaysia for the period of 1991 to 2006 by using Granger Causality test and Toda Yamamoto's non causality test to examines the directional relationship among variables. Study reveals that economic performance has a major role in attracting FPI in Malaysia.

3. Methods of the Study

To investigate the association amongst Financial Liberalization and Carbon Emission, this study uses Exchange rates, trade openness, FDI, Money Supply, deposit rate and lending rate and Foreign Portfolio Investment as proxies of financial liberalization. The Study uses Financial liberalization and Economic Growth as an independent variable while Carbon dioxide emission as a dependent variable because it harms the environment in many ways like climatic changes occurs due to rise in the level of CO₂ emission in air. It is measured in metric tons and previously used in several studies like (Kocak Emrah 2018 ;Mirza & Kanwal, 2017; Shahzad, & Mahalik, 2018). To check the Stationary Properties of the variables, some important unit root tests such as Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root tests (Shahzad, 2017). To examine the Long run Cointegration between variables, Johnson Test of Cointegration is used (Ilkin Mammadov, Fariz Ahmadov, 2021) finally; the study uses VECM (Hasan, Oudat, & Alsmadi, 2021).

4. Model Specification

$$CO_2t = \alpha_0 + \alpha_1 LIBt + \alpha_2 T + \epsilon_1$$

Whereas, CO₂ represents carbon dioxide emission and LIB represents financial liberalization index which would be estimated through Principal Component Analysis (PCA) and α_1 is the coefficient of LIB, T is the structural break in series, while ϵ_1 represent error term.

4.1.1 Unit Root Test

Unit root test for the variables used in this study is perhaps the essential part in identifying which econometric model is used (Asumadu-Sarkodie & Owusu, 2017). Performing unit root minimizes false regression and make sure that utilized variables are stationary by differencing them and estimating the equation of interest through the Stationary process (Asumadu-Sarkodie & Owusu, 2016). The study uses ADF and PP to test unit root (Minh, 2020) While test is conducted for this study in INTERCEPT ONLY and INTERCEPT AND TREND respectively, for both at Level and at 1st Difference respectively (Wang, Mirza, Vasbieva & Abbas, 2020). The Null Hypothesis of ADF and PP are that there is a unit root. If the value of p is more than 0.05 or 5%, or the t value is less than Critical Value than it means that there is a unit root and thus, it cannot reject the Null hypothesis. But if the value of p is less than 0.05 or 5%, or t value is more than Critical Value, it means the series is stationary and thus it reject the Null Hypothesis (Y. Zhang, 2018)

4.1.2 Lag Length

This study uses Johansen cointegration test because the outcomes of unit root predicted that Carbon Dioxide Emission and Financial Liberalization are stationary at 1st difference and when variables are stationary same order, Johansen Cointegration is employed (Matthew, 2019). The lag selection criteria for Johansen co-integration is found by using unrestricted VAR (Md Reza, Fan, Wand, Bhuiyan, & KM Mehedi, 2019).

4.1.3 Johansen Cointegration

Having confirmed that variables are stationary at 1st difference i.e, I(1), the Cointegration Test were done between the Carbon Dioxide Emission and Financial Liberalization by employing Johansen Cointegration (Adamopoulos, 2020) Johansen Test of Co-integration is used to analyze the cointegrations among variables (Mugableh, 2021). As presented in Table 4, that the variables have become free from Unit Root issues at first difference and the number of lag is selected by using optimum lag selection criteria presented in Table 5. Now Johansen test of co-integration is used (Asumadu-Sarkodie & Owusu, 2017).

4.1.4 Vector Error Correction Model (VECM)

If the variables have long run association or co-integration than VECM can be run but if the variables do not have any association then unrestricted VAR model is used. Findings of Table 6 of Johansen cointegration reveal that there exists a co-integration among Financial Liberalization and Carbon Dioxide Emission. The study continues with the vector error correction model (VECM) to check the short-run linkages among the variables VECM (Hasan et al. 2021).

5. Empirical Result and Discussion

5.1. Unit Root Test

The result for unit root test is shown in table 4.1. The outcomes indicates that Carbon dioxide emission (CO₂), Financial Liberalization Index (FLIB) and GDP has a unit root (non-stationary) at level with the t value is more than critical value, but after taking 1st difference, the variables become stationary (Minh, 2020; Mukhtarov et al. 2020). So this study uses Johansen Co-integration because variables are stationary at 1st Difference I(1) (Hasan et al. 2021).

Table 5.1: Unit root tests results.

Variables	Intercept		Intercept & Trend	
	Level	1 st Difference	Level	1 st Difference
ADF	-1.7611[0]	-5.8204[0]***	-3.5114[4]*	-6.2953[0]***
CO ₂	-0.4483[0]	-5.1121[0]***	-4.0336[5]**	-4.9896[0]***
FLIB	0.6631[0]	-5.3171[0]***	-1.3144[0]	-5.6863[0]***
GDP				
PP				
CO ₂	-1.7062[3]	-5.8867[3]***	-0.9693[3]	-6.2719[3]***
FLIB	-0.41990[2]	-5.1104[1]***	-2.4673[2]	-4.9793[2]***
GDP	0.6356[1]	-5.3176[1]***	-1.3144[0]	-5.7438[3]***

Note: The null hypothesis for ADF and PP tests is that a series has a unit root. ***, **, * denote that the series is stationary at 1%, 5% and 10% level of significance, respectively. Whereas the [] represents the lag-length.

Cointegration Analysis

5.2. Lag Length

The lag selection criteria for Johansen co-integration is found by using unrestricted VAR (Reza, Fan, Wand, Bhuiyan, & Mehedi, 2019). The table 5.2 identifies the result of different lag selection criteria tests like LR, FPE, AIC, SC, and HQ. The study uses LR, SC and HQ for its dependent and independent variables (Rana & Sharma, 2020). According to LR, SC and HQ the lag length of 1 is desirable. So this study uses 1 lag for Johansen Test of Cointegration (Hassan, Oudat, & Alsmadi, 2021) and VECM (Mugableh, 2021).

Table 5.2: Optimal Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	25.22312	NA	5.00e-05	-1.388945	-1.251532	-1.343396
1	128.9158	181.4622*	1.35e-07	-7.307239	-6.757588*	-7.125045*
2	139.3447	16.29507	1.26e-07*	-7.396541*	-6.434652	-7.077702
3	147.1751	10.76692	1.41e-07	-7.323447	-5.949319	-6.867962

5.3. Johansen Cointegration

The outcomes of Johansen Co integration test is presented in table 5.3. The null hypothesis for “None” shows that the value of Trace statistic of 32.81 is more than the 0.05 critical value of 29.79 and the p value of 2.18% is also less than 5% hence the null hypothesis of no cointegration is rejected. For “At most 1” and “At most 2” the trace statistic is less than 0.05 critical values and the p value is also more than 5 percent, the null hypothesis cannot be rejected. Furthermore the same analysis is done for Max-Eigen test where the null hypothesis of “None” cannot be rejected because the Max- Eigen statistic of 25.13 is more than the 0.05 critical values of 21.13 and the p value of 1.29% is less than 5%. However, For “At most 1” and At most 2” the Max-Eigen statistic is less than 0.05 critical values and the p value is more than 5%. This result indicates the 1 co-integrating equations at 5% significance (Dhiab&Dkhili, 2019).

As shown in table 5.3, the result reveals the existence of long run association amongst Financial Liberalization, Economic Growth and Carbon Emission. Accordingly, the variables will move together (Hassan, Oudat, Alsmadi, 2021). Apparently, after confirming the existence of co-integration the study uses VECM.

Table 5.3: Result of Johansen Cointegration

Unrestricted Co integration Rank Test (Trace)				
Hypothesized NO OF CE(s)	Eigenvalue	Trace Stat	0.05 Critical Value	Prob**
None*	0.533096	32.81036	29.79707	0.0218
At most 1	0.199805	7.676500	15.49471	0.5006
At most 2	0.009674	0.320812	3.841466	0.5711

Unrestricted Co integration Rank Test (Maximum Eigen value)				
Hypothesized NO OF CE(s)	Eigenvalue	Max-Eigen Stat	0.05 Critical Value	Prob**
None*	0.533096	25.13386	21.13162	0.0129
At most 1	0.199805	7.355688	14.26460	0.4480
At most 2	0.009674	0.320812	3.841466	0.5711

5.4. Vector Error Correction Model (VECM)

The outcomes of VECM are shown in table 5.4. The long run equilibrium relationship amongst the variables has a significant impact. The coefficient of error correction term is -0.118099 which means when CO₂ is disturbed and deviated from equilibrium, it requires 0.118099 speed adjustment of another side to make it possible to come back to equilibrium level in the short run (Bekhet, Othman, & Yasmin, 2020). The Co efficient of CO₂ is

Negative and Significant. The result of Least Squares is presented in table 1 in Appendix A. The C (1) is the residual of the one period lag of the cointegrating equation amongst Carbon dioxide emission (CO₂), Economic Growth and Financial Liberalization index (FLIB). It's sign negative and also statistically significant. The *p* value of 0.00% is less than 5%, when the *p* value, is less than 5% than the particular variable become significant (Majumder, 2016). So in this study the result shows that ECT is negative with *p* value less than 5% it means that Financial Liberalization, Economic Growth and Carbon Dioxide Emissions has a significant long-run positive association, which is presented in Table 1 in Appendix A. The outcomes of this study is the same with previous studies like (Khan, Khan &Rehan, 2020;Shahbaz et al. 2020)

To check the Short run relationship this study uses Chi-square value of Wald Statistics (Omoke, Nwani, Effiong, 2020). Table A1 in Appendix presents the result of short run relationship of Financial Liberalization, Economic Growth and Carbon Emission. C (3) and C (4) are the coefficients of financial liberalization and Economic Growth respectively. If the coefficient of financial liberalization and economic growth influences carbon dioxide emission then there is a short run causality running from financial liberalization to carbon dioxide emission and economic growth to carbon dioxide emission respectively. The result of Wald test is presented in table A1 indicates that the chi-square probability is 72.64% which is more than 5%, the null hypothesis cannot be rejected. The result indicates that there is no short run relationship between financial liberalization and carbon emission. However, the chi-square probability for economic growth and carbon emission is 0.47% which is less than 5%. The Null Hypothesis is rejected. It means economic growth triggers carbon emission in short run.

There are few conditions that check the specifications of the model that either the variables are normally distributed, is there any serial correlation issues and is there any ARCH effects in it or not. The results of diagnostic tests are presented in Appendix. The result of serial correlation is presented in Table A2, which shows no serial correlation issues. The result of ARCH effect is shown in Table A3, which shows model is free of Heteroskedasticity issues and Figure 1 shows the normal distribution. These results indicate that the model used in this study is efficient, and finally the Figure 2 and 3 shows that CUSUM and CUSUMsq do not exceed the critical boundaries at 5% level of significance (Rahman, Ghazali, Bhatti, & Khan, 2020).

Table 5.4: Result of VECM

E. C:	D(C02)	D(FLIB)	D(GDP)
CointEq1	-0.118099 (.02461) [-4.79879]	-0.194881 (0.67954) [0.28678]	-0.017973 (0.04048) [0.44398]
D(CO ₂ (-1))	-0.441714 (.15605) [-2.83065]	-2.609711 (4.30877) [-0.60567]	0.121062 (0.25668) [0.47164]
D(FLIB(-1))	-0.003167 (.00905)	0.068909 (0.24995)	0.021114 (0.01489)

	[-0.34992]	[0.27569]	[1.41798]
D(GDP(-1))	0.307816 (0.10888) [2.82701]	-1.403472 (3.00650) [-0.46681]	0.017321 (0.17910) [0.09671]
C	0.015648 (0.00435) [3.59823]	0.220454 (0.12008) [1.83592]	0.012046 (0.00715) [1.68399]

Conclusion

We explore the relationship by investigating the effects of Financial Liberalization, Economic Growth and CO2 Emission in Pakistan. For this purpose the annual time series data is collected from state bank of Pakistan, IMF and the World Bank. The study uses PCA to construct Financial Liberalization Index for its variables. The results of Johansen Test of Cointegration indicate the Long run association amongst variables (Wang et al. 2020). While VECM identify the existence of Positive long run relationship amongst Financial Liberalization, Economic Growth and Carbon Dioxide Emission. The Wald Test identifies short run relationship between economic growth and financial liberalization whereas; no relationship is identified between Financial Liberalization and CO2. The outcomes of our study are the same with the results of those (Shen, Su, Malik, Umar, Khan, 2021 ;Shahbaz et al. 2020;Shahzad et al. 2017).

Even though this study has done enough to investigate the association of Financial Liberalization, economic growth and Carbon Dioxide Emission, however, the limitations of the study cannot be avoided. Future studies may consider different proxies for Financial Liberalization in order to provide more rigorous insights. The generalization of our findings is limited to the Pakistan only; future research may consider sample of countries across developed, emerging and developing markets in order to provide better insights to the policy makers, investors and other stakeholders. Based on the outcomes, the study recommends some suggestion for the policymakers. Firstly, the government should reduce the exploitation of natural resources. Secondly, Government should take such measures which diminish environmental degradation by imposing tax and thirdly, since economic activity has a major role in the development of country so it is linked with green investment. Finally; government should increase the renewable energy share to ensure cleaner production and reduction in carbon emission.

References

- Adamopoulos, A. (2020). Financial development and economic growth: an empirical investigation of three European Union Member-countries.
- Adebola, S., & Al-Mulali, U. (2018). Influence of foreign direct investment on indicators of environmental degradation. *Environmental Science and Pollution Research*, 25(25), 24845-24859.
- Afridi, M. A., Kehelwalatenna, S., Naseem, I., & Tahir, M. (2019). Per capita income, trade

openness, urbanization, energy consumption, and CO₂ emissions: an empirical study on the SAARC Region. *Environmental Science and Pollution Research*, 26(29), 29978-29990.

Ahmad, F., Yang, S.-C., & Draz, M. U. (2015). Causality between foreign portfolio inflows and economic growth: Evidence from China and India. *International Journal of Economics and Finance*, 7(10), 163-172.

Albulescu, C. T. (2015). Do Foreign Direct and Portfolio Investments Affect Long term Economic Growth in Central and Eastern Europe? *Procedia Economics and Finance*, 23, 507-512.

Aman, Q., Ullah, I., & Khan, M. I. (2017). Linkages between exchange rate and economic growth in Pakistan (an econometric approach). *European Journal of Law and Economics*, 44(1), 157-164.

Ansari, M. A., Haider, S., & Khan, N. A. (2020). Does trade openness affects global carbon dioxide emissions: evidence from the top CO₂ emitters. *Management of Environmental Quality: An International Journal*.

Antweiler, W., Copeland, B. R., & Taylor, M. S. (2001). Is free trade good for the environment? *American economic review*, 91(4), 877-908.

Asumadu-Sarkodie, S., & Owusu, P. A. (2016). Carbon dioxide emissions, GDP, energy use, and population growth: a multivariate and causality analysis for Ghana, 1971–2013. *Environmental Science and Pollution Research*, 23(13), 13508-13520.

sumadu-Sarkodie, S., & Owusu, P. A. (2017). The causal effect of carbon dioxide emissions, electricity consumption, economic growth, and industrialization in Sierra Leone. *Energy Sources, Part B: Economics, Planning, and Policy*, 12(1), 32-39.

Awodumi, O. B., & Adewuyi, A. O. (2020). The role of non-renewable energy consumption in economic growth and carbon emission: Evidence from oil producing economies in Africa. *Energy Strategy Reviews*, 27, 100434.

Azam, M., Khan, A. Q., Abdullah, H. B., & Qureshi, M. E. (2016). The impact of CO₂ emissions on economic growth: evidence from selected higher CO₂ emissions economies. *Environmental Science and Pollution Research*, 23(7), 6376-6389.

Bekhet, H.A., Othman, N.S., & Yasmin, T. (2020). Interaction Between Environmental Kuznet Curve and Urban Environment Transition Hypothesis in Malaysia. *International Journal of Energy Economics and Policy*, 10(1), 384- 402.

Bildirici, M., & Gokmenoglu, S. M. (2020). The impact of terrorism and FDI on environmental pollution: Evidence from Afghanistan, Iraq, Nigeria, Pakistan, Philippines, Syria, Somalia, Thailand and Yemen. *Environmental Impact Assessment Review*, 81, 106340.

Chaitip, P., Chokethaworn, K., Chaiboonsri, C., & Khounkhalax, M. (2015). Money supply influencing on economic growth-wide phenomena of AEC open region. *Procedia Economics and Finance*, 24, 108-115.

Chang, S.-C., & Li, M.-H. (2019). Impacts of foreign direct investment and economic development on carbon dioxide emissions across different population regimes. *Environmental and resource economics*, 72(2), 583-607.

Chaudhry, I. S., Farooq, F., & Mushtaq, A. (2014). Factors affecting portfolio investment in Pakistan: evidence from time series analysis. *Pakistan Economic and Social Review*, 141-158.

Cheema, A. R. (2015). Pakistan: High-rise buildings worsened heatwave. *Nature*, 524(7563), 35.

- Chen, S.-S. (2017). Exchange rate undervaluation and R&D activity. *Journal of International Money and Finance*, 72, 148-160.
- ChiWei, S., JiaoJiao, F., HsuLing, C., & XiaoLin, L. (2016). Is there causal relationship between money supply growth and inflation in China? Evidence from quantity theory of money. *Review of Development Economics*, 20(3), 702-719.
- Copeland, A., Hall, G., & Maccini, L. J. (2019). Interest rates and the market for new light vehicles. *Journal of Money, Credit and Banking*, 51(5), 1137-1168.
- Dhiab, L. B., & Dkhili, H. (2019). Impact of income, trade, urbanization, and financial development on CO2 emissions in the GCC countries.
- Dhrifi, A., Jaziri, R., & Alnahdi, S. (2020). Does foreign direct investment and environmental degradation matter for poverty? Evidence from developing countries. *Structural Change and Economic Dynamics*, 52, 13-21.
- Dimitris K. Christopoulos (2004) Currency devaluation and output growth: new evidence from panel data analysis, *Applied Economics Letters*, 11:13, 809-813
- Duasa, J., & Kassim, S. H. (2009). Foreign portfolio investment and economic growth in Malaysia. *The Pakistan Development Review*, 109-123.
- Essandoh, O. K., Islam, M., & Kakinaka, M. (2020). Linking international trade and foreign direct investment to CO2 emissions: Any differences between developed and developing countries? *Science of The Total Environment*, 136437.
- Gokmenoglu, K. K., & Sadeghieh, M. (2019). Financial development, CO2 emissions, fossil fuel consumption and economic growth: the case of Turkey. *Strategic Planning for Energy and the Environment*, 38(4), 7-28.
- Haider, M. A., Khan, M. A., & Abdulahi, E. (2016). Determinants of foreign portfolio investment and its effects on China. *International Journal of Economics and Finance*, 8(12), 143-150.
- Hasan, H., Oudat, M. S., Alsmadi, A. A., Nurfahasdi, M., & Ali, B. J. (2021). INVESTIGATING THE CAUSAL RELATIONSHIP BETWEEN FINANCIAL DEVELOPMENT AND CARBON EMISSION IN THE EMERGING COUNTRY. *Journal of Governance and Regulation*/Volume, 10(2).
- Hussain, M. I., & Zafar, T. (2018). The interrelationship between money supply, inflation, public expenditure and economic growth. *European Online Journal of Natural and Social Sciences*, 7(1), pp. 1-24.
- Ibrahiem, D.M. (2020). Do technological innovations and financial development improve environmental quality in Egypt? *Environmental Science and Pollution Research*, 1-13.
- Imran, H., syed, R. M. F., Gago-de-Santos, P., & Abbas, Q. (2019). Fossil fuels, foreign direct investment, and economic growth have triggered CO2 emissions in emerging Asian economies: some empirical evidence. *Energy*, 171, 493-501.
- Jiang, C., & Ma, X. (2019). The impact of financial development on carbon emissions: a global perspective. *Sustainability*, 11(19), 5241.
- Kayani, G. M., Ashfaq, S., & Siddique, A. (2020). Assessment of financial development on environmental effect: implications for sustainable development. *Journal of Cleaner Production*, 261, 120984.
- Khan, M. K., Khan, M. I., & Rehan, M. (2020). The relationship between energy consumption, economic growth and carbon dioxide emissions in Pakistan. *Financial Innovation*, 6(1), 1-13.

- Khan, M. S. (2019). Money, Output and Inflation in Bangladesh: A Test of Cointegration and Causality. *Money*, 10(10).
- Kocak.,E, & Şarkgüneşi, A. (2018). The impact of foreign direct investment on CO 2 emissions inTurkey: new evidence from cointegration and bootstrap causality analysis. *Environmental Science and Pollution Research*, 25(1), 790-804.
- Lv, Z., & Xu, T. (2019). Trade openness, urbanization and CO2 emissions: Dynamic panel data analysis of middle-income countries. *The Journal of International Trade & Economic Development*, 28(3), 317-330.
- Mahmood, H., Maalel, N., & Zarrad, O. (2019). Trade Openness and CO2 Emissions: Evidence fromTunisia. *Sustainability*, 11(12), 3295.
- Majumder, S. C. (2016). Inflation and its impacts on economic growth of Bangladesh. *American Journal of Marketing Research*, 2(1), 17-26.
- Makoni, P. L., & Marozva, G. (2018). The Nexus between Foreign Portfolio Investment and Financial Market Development: Evidence from Mauritius. *Academy of Strategic Management Journal*, 17(5), 1-14.
- MAMMADOV, I., & AHMADOV, F. (2021). Financial Development and Economic Growth: Evidence From Azerbaijan. *WSEAS Transactions on Business and Economics*, 18, 237-252.
- Mansour, M., Sghaier, A., Bannour, B., & Ben Jabeur, S. (2019). The Interactions between the Lending Rates, Deposit Rates and Money Market Rates. *Iranian Economic Review*, 23(1), 163-189.
- McKinnon, R. I. (1973). *Money and Capital in Economic Development* (Washington, DC: BrookingsInstitution, 1973). McKinnonMoney and Capital in Economic Development 1973.
- Md Reza, S., Fan, H., Wang, B., Bhuiyan, M. A., & KM Mehedi, A. (2019). Trade (exports) as an opportunity for Bangladesh: A VECM analysis. *The International Trade Journal*, 33(1), 95-110.
- Menon, P. (2019). An Indian story on carbon emission, energy consumption, trade openness, and financial development. *Journal of Public Affairs*, e1953.
- Minh, N. N. (2020). Foreign direct investment and carbon dioxide emissions: Evidence from capital of Vietnam. *International Journal of Energy Economics and Policy*, 10(3), 76-83.
- Mirza, F. M., & Kanwal, A. (2017). Energy consumption, carbon emissions and economic growth inPakistan: Dynamic causality analysis. *Renewable and Sustainable Energy Reviews*, 72, 1233-1240.
- Mohapatra, S. M. (2019). Exchange rate exposure and firm productivity in India. *Journal of FinancialEconomic Policy*.
- Mugableh, M. I. (2021). An Examination Into the Causal Links Among Inward FDI Determinants: Empirical Evidence From Jordan. *International Journal of Financial Research*, 12(2), 195-201.
- Mukhtarov, S., Humbatova, S., Seyfullayev, I., & Kalbiyev, Y. (2020). The effect of financial development on energy consumption in the case on Kazakhstan. *Journal of Applied Economics*, 23(1), 75- 88.
- Munir, S., Chaudhry, I. S., & Akhtar, M. H. (2013). Financial Liberalization and Economic Growth inPakistan: Empirical Evidence from Co-integration Analysis. *Pakistan Journal of Social Sciences (PJSS)*, 33(2).

- Nasir, M. A., Huynh, T. L. D., & Tram, H. T. X. (2019). Role of financial development, economic growth & foreign direct investment in driving climate change: A case of emerging ASEAN. *Journal of environmental management*, 242, 131-141.
- Neftel, A., Moor, E., Oeschger, H., & Stauffer, B. (1985). Evidence from polar ice cores for the increase in atmospheric CO₂ in the past two centuries. *Nature*, 315(6014), 45.
- Ofori, C. F., Danquah, B. A., & Zhang, X. (2017). The Impact of Money Supply on Inflation, A Case of Ghana. *Imperial Journal of Interdisciplinary Research*, 3(1).
- Ogunmuyiwa, M., & Ekone, A. F. (2010). Money supply-economic growth nexus in Nigeria. *Journal of Social Sciences*, 22(3), 199-204.
- Okafor, I., Ugochukwu, U.S., & Chijindu, E. H. (2016). Foreign capital inflows and Nigerian economic growth nexus: A Toda Yamamoto approach. *European Journal of Accounting, Auditing and Finance Research*, 4(3), 16-26.
- Omoke, P. C., Nwani, C., Effiong, E. L., Egbuonwan, O. O., & Emekwe, C. C. (2020). The impact of financial development on carbon, non-carbon, and total ecological footprint in Nigeria: new evidence from asymmetric dynamic analysis. *Environmental Science and Pollution Research*, 27(17), 21628-21646.
- Osho, A. E., & Efuntade, A. O. (2019). Effect of Exchange Rate Fluctuation on the Financial Performance Evaluation of Multinational Companies in Nigeria.
- Phuong, N. D. (2018). The relationship between foreign direct investment, economic growth and environmental pollution in vietnam: an autoregressive distributed lags approach. *International Journal of Energy Economics and Policy*, 8(5), 138-145.
- Rahman, H. U., Ghazali, A., Bhatti, G. A., & Khan, S. U. (2020). Role of economic growth, financial development, trade, energy and FDI in environmental Kuznets curve for Lithuania: evidence from ARDL bounds testing approach. *Engineering Economics*, 31(1), 39-49.
- Rahman, M., Nower, N., Tushar, R. H., Abbas, S. M., & Musa, M. N. (2019). Impact of Monetary Policy on the Economic Growth of a Developing Country: An Empirical Study on Bangladesh Economy. Nowshin and Tushar, Raqibul Hasan and Abbas, Syed Mahdee and Musa, Maisha Nanjiba, *Impact of Monetary Policy on the Economic Growth of a Developing Country: An Empirical Study on Bangladesh Economy* (May 20, 2019).
- Rana, R., & Sharma, M. (2020). Dynamic Causality among FDI, Economic Growth and CO₂ Emissions in India with Open Markets and Technology Gap. *International Journal of Asian Business and Information Management (IJABIM)*, 11(3), 15-31.
- Rodrik, D. (2008). The Real Exchange Rate and Economic Growth. *Brookings Papers on Economic Activity* 2008(2), 365-412.
- Shahbaz, M., Haouas, I., Sohag, K., & Ozturk, I. (2020). The financial development environmental degradation nexus in the United Arab Emirates: the importance of growth, globalization and structural breaks. *Environmental Science and Pollution Research*, 1-15.
- Shahbaz, M., Shahzad, S. J. H., & Mahalik, M. K. (2018). Is globalization detrimental to CO₂ emissions in Japan? New threshold analysis. *Environmental Modeling & Assessment*, 23(5), 557-568.
- Shahbaz Muhammad, Nasreen, S., Ahmed, K., & Hammoudeh, S. (2017). Trade openness carbon emissions nexus: the importance of turning points of trade openness for country panels. *Energy Economics*, 61, 221-232.

- Shaheen, A., Sheng, J., Arshad, S., Salam, S., & Hafeez, M. (2020). The Dynamic Linkage between Income, Energy Consumption, Urbanization and Carbon Emissions in Pakistan. *Polish Journal of Environmental Studies*, 29(1).
- hahzad, S. J. H., Kumar, R. R., Zakaria, M., & Hurr, M. (2017). Carbon emission, energy consumption, trade openness and financial development in Pakistan: A revisit. *Renewable and Sustainable Energy Reviews*, 70, 185-192.
- Shao, Y. (2018). Does FDI effect carbon intensity? New evidence from dynamic panel analysis. *international Journal of Climate Change Strategies and Management*, 10(1), 27-42.
- Shaw, E. S. (1973). Financial deepening in economic development.
- Shen, Y., Su, Z. W., Malik, M. Y., Umar, M., Khan, Z., & Khan, M. (2021). Does green investment, financial development and natural resources rent limit carbon emissions? A provincial panel analysis of China. *Science of the Total Environment*, 755, 142538.
- Sultana, N., Koli, R., & Firoj, M. (2019). Causal Relationship of Money Supply and Inflation: A Study of Bangladesh. *Asian Economic and Financial Review*, 9(1), 42-51.
- Victor, C., Kizito, O., & Chinonye, I. (2019). IMPACT OF EXCHANGE RATE FLUCTUATION ON SELECTED ECONOMIC SECTORS OF THE NIGERIAN ECONOMY. *Policy*, 8(1), 21-36.
- Wang, R., Mirza, N., Vasbieva, D. G., Abbas, Q., & Xiong, D. (2020). The nexus of carbon emissions, financial development, renewable energy consumption, and technological innovation: what should be the priorities in light of COP 21 Agreements?. *Journal of Environmental Management*, 271, 111027.
- Waqas, Y., Hashmi, S. H., & Nazir, M. I. (2015). Macroeconomic factors and foreign portfolio investment volatility: A case of South Asian countries. *Future Business Journal*, 1(1-2), 65-74.
- Wasti, S. K. A., & Zaidi, S. W. (2020). An empirical investigation between CO2 emission, energy consumption, trade liberalization and economic growth: A case of Kuwait. *Journal of Building Engineering*, 28, 101104.
- Zhang, S. (2018). Is trade openness good for environment in South Korea? The role of non-fossil electricity consumption. *Environmental Science and Pollution Research*, 25(10), 9510-9522.
- Zhang, Y., & Zhang, S. (2018). The impacts of GDP, trade structure, exchange rate and FDI inflows on China's carbon emissions. *Energy policy*, 120, 347-353.

Appendix

Table A1: Result of Least Squares (Gauss- Newton / Marquardt steps)

	Co efficient	S.E	t-stat	p-value.
C(1)	-0.118099	.024610	-4.798786	.0000
C(2)	-0.441714	.156047	-2.830651	.0085
C(3)	-0.003167	.009052	-0.349916	.7290
C(4)	0.307816	.108884	2.827011	.0086
C(5)	0.015648	.004349	3.598228	.0012
C(1)	-0.118099	.024610	-4.798786	.0000
R ²	0.519291	Mean dep var.		.014242
R ² (Adj.)	0.450618	S.D. dep var.		.025761
S.E. of reg.	0.019094	AIC.		-4.940128
Sum sqresid	0.010209	SC.		-4.713384
Log likelihood	86.51210	HQ.		-4.863835
F-stat	7.561811	D-Watson stat		2.289828
Prob. (F-stat)	0.000291			

Table A2: Result of Wald Test

Test-Statistic	Value	Df	P-value
FLIB			
F-stat	0.122441	(1, 28)	0.7290
Chi-sq	0.122441	1	0.7264
H ₀ C(3)=0			
GDP			
F-statistic	7.991993	(1, 28)	0.0086
Chi-sq	7.991993	1	0.0047
H ₀ C(4)=0			

Table A3: Result of Breush- Godfrey Serial Correlation LM Test

F-stat	2.781858	Prob. F(1,27)	.1069
Obs*R ²	3.082458	Prob. Chi-Sq(1)	.0791

Table A4: Heteroskedasticity Test ARCH

F-stat	.003469	Prob. F(1, 30)	.9534
Obs*R ²	.003700	Prob. Chi-Square(1)	.9515

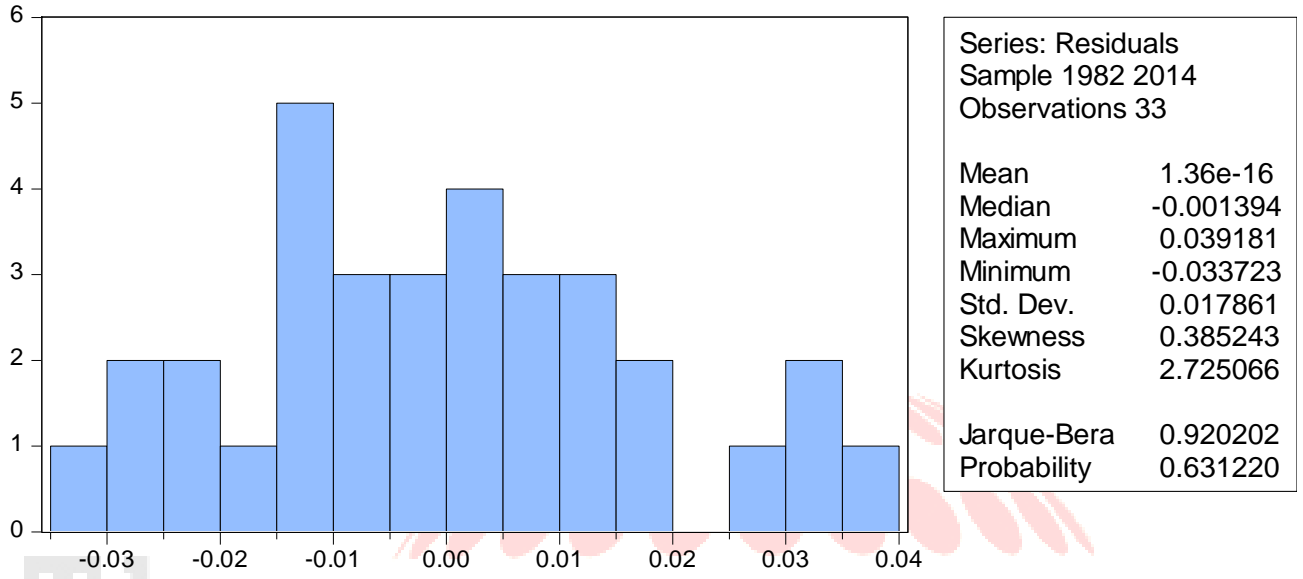


Figure 1: Figure of Normality Test

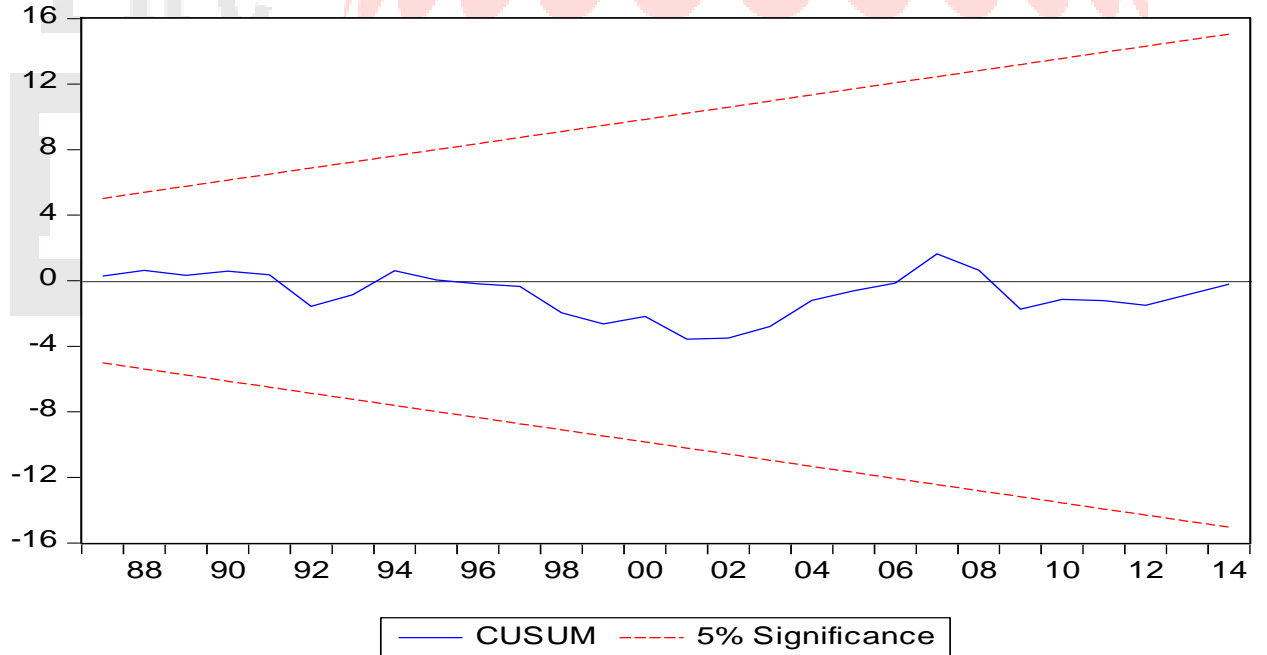


Figure 2: Figure of CUSUM Test

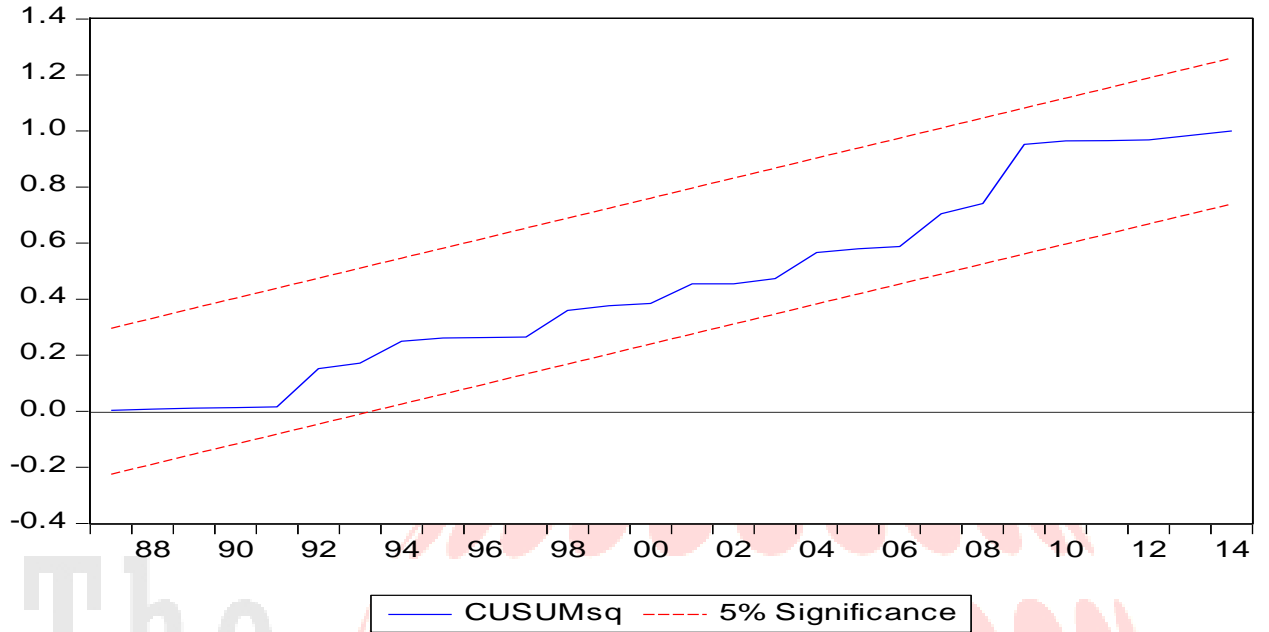


Figure 3: Figure of CUSUM of Squares

The
Discourse