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Causality between Environment and Financial Development in case of Pakistan: A Time Series Analysis

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ABSTRACT

Climate change is now widely regarded as one of the greatest issues of our era. As a result, it is critical to study the impact of various macroeconomic variables on the environment. The purpose of this research is to look at the link between financial development and environmental (CO2 emissions) in Pakistan from 1980 to 2014. The Auto Regressive Distributed Log (ARDL) technique was employed to track both long-term and short-term association between variables in this investigation. Granger causal testing is used to examine the causal relationship. Study results suggest that there is a unidirectional causality between CO2 and the financial development Index. However, the environment (CO2 emissions) in the long run will depend on the financial development that the financial development index (domestic credit to private sector aggregate market capitalization, and FDI) has in Pakistan. In the second model, the environment (energy consumption) also depends on financial development.

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1. Introduction

The purpose of this study is to look at the link in carbon dioxide and the environment (CO2) to what is thought to be the central greenhouse gas emitted by human activities. It decomposes naturally as part of the carbon cycle on Earth (natural circulation of carbon between the atmosphere, oceans, soil, plants and animals). The amount of radiation released from the atmosphere is determined by the quantity of greenhouse gases in the atmosphere (carbon dioxide, methane, etc.). Human activities affect the carbon cycle by increasing CO2 levels in the atmosphere and prompting natural sinks' capacity to remove CO2 from the atmosphere. CO2 emissions come from a variety of natural sources, but human-caused emissions have contributed to the rise in the atmosphere since the Industrial Revolution (Hussmann et al., 2010).

As a result, the environment has become a scarce resource and since economics can help combat scarce resources, it is ideal for dealing with environmental issues. Another approach to employ economics is to ensure that environmental initiatives' costs and benefits are adequately matched. Although estimating the costs and benefits is challenging, it is becoming increasingly necessary for every government to do so before establishing an environmental strategy. Environmental goals can sometimes achieved more effectively via the use of market-based mechanisms than through traditional directives.

Any country's economic progress is influenced by its energy usage. It improves the country's efficiency and production while also having a significant impact on people and households. In the Energy Economics literature, the importance of energy in economic development is widely recognized. The "energy and GNP" causal link refers to the unidirectional causation between energy consumption and economic growth, however the direction of causality shifted from GNP to energy consumption between 1947 and 1974. Christ and Christ (1997) suggests a bidirectional causality between energy consumption and GNP. In cross-country analysis, Errol and Yu (1987) developed mixed results from different countries. They pointed out a unidirectional causality for West Germany and a bidirectional causality for Italy, Japan, the UK, Canada and France. Paul and Bhattacharya (2004) examined the crucial link between India's energy use and economic growth. Riaz and Stern (1984) use a basic log linear regression analysis to look at the link between energy use and economic growth in Pakistan. Surprisingly, the findings revealed no evidence of a link between economic development and energy use. According to S. Alam and Butt (2002), energy consumption and economic growth have a one-way relationship, with the causality going from energy consumption to economic growth.

A developed and prosperous financial sector promotes economic growth and also reduces environmental pollution. Financial markets that have matured can aid in attracting foreign direct investment and stimulating economic growth. The financial development is very useful for modern eco-friendly technology. It demonstrates that economic development has a direct influence on energy use (Sadorsky, 2010) and CO_2 emissions (Tamazian, Chousa, & Vadlamannati, 2009). The modern banking industry lowers financing costs and promotes investment. Shahbaz (2010) and reduces gas emissions by enhancing energy efficiency. Thus, a strong financial sector promotes technology in the targeted energy sector. Thus, it helps significantly to reduce pollution.

Economic and environmental goals are often seen as conflicting. It is believed that one has to choose between one and the other and both cannot be achieved at once. Literature set emphasizing the link between carbon emissions and international commerce suggests that pollution occurs during the manufacturing of goods and is linked to international consumption. As a result, the economic stimulation provided by overseas commerce can have a considerable influence on the country's pollution levels (Ozturk & Salah Uddin, 2012).

On the other side, many researchers have investigated the impact of financial development on carbon emissions, such as (Dasgupta, Laplante, & Mamingi, 2001; Frankel & Romer, 1999; Zhang, 2011), who believe that financial growth raises carbon emission levels. According to these studies, financial development causes an increase in carbon emissions for the following reasons: To begin with, stock market development aids listed firms in lowering financial expenses, increasing funding mechanisms, increasing operational risk, and increasing inventory/debt, as well as allowing new investments in new projects that consume more energy and produce more carbon. Second, financial development may aid in the attraction of foreign direct investment, which can boost economic growth while simultaneously raising carbon emissions.

Third, consumer credit services seem to require efficient and effective financial well-being, making it easier to purchase large ticket items such as cars, homes, air conditioners, refrigerators, and washing machines, etc. It then releases more carbon dioxide (Zhang, 2011). However, (Claessens & Feijen, 2007; Tamazian et al., 2009) argue that financial improvements can improve energy efficiency and business performance and thus reduce energy consumption.

Pakistan is currently experiencing the worst energy crisis in its history, with Pakistan's energy needs set to treble in the coming years. Financial development may be a valuable instrument for improving economic growth efficiency and lowering energy usage. As a result, the aim of this research is to determine the link between financial development and the environment. As a result, financial development entails the creation and extension of institutions, tools, and markets that facilitate investment and growth.

2. Literature Review

Shahbaz (2010) examined whether financial instability has resulted in increased pollution in Pakistan. The time span was 1972–2009 to be analyzed. The determinants include economic development, financial instability, energy consumption, trade openness, and CO2 emissions. The data were compiled by World Development Indicators. Long-term associations were analyzed using the ARDL approach, whereas short-term relationships were analyzed using the error correction method. According to the outcomes, financial instability, wealth, energy consumption, and trade openness all have a positive correlation with CO2 emissions in Pakistan. As a result, financial instability leads to the country's growing pollution.

Shahbaz, Solarin, Mahmood, and Arouri (2013) analyze the South African ecosystem's impact of financial development, economic growth, coal consumption, and trade openness. From 1965 to 2008, annual data on the South African economy were collected. The ARDL cointegration approach was used to examine long-term relationships between variables, whilst the ECM methodology was used to examine short-term correlations. The study discovered a high and significant relationship between coal consumption and CO2 emissions, but a positive and relatively modest relationship between economic growth and CO2 emissions. Similarly, the relationship between financial development and CO2 emissions was insignificant, as was the relationship between trade openness and CO2 emissions.

Muhammad (2012) investigates into the relationship between economic growth, energy efficiency, financial development, and CO2 emissions in Portugal. Data were gathered from the World Development Indicator Between 1971 and 2009. The ADRL method is used to evaluate the long-term relationship between economic growth, energy efficiency, financial development, and CO2 emissions. The results indicated that the variables had a long-run co-integrated association. They demonstrated that economic growth and energy efficiency increase CO2 emissions, whereas financial development decreases them.

In the example of Pakistan, Shahbaz, Ahmad, and Chaudhary (2008) evaluated the causal association among energy consumption, financial development, and economic growth. Time series data were obtained between 1971 and 2009. To find long-term relationships in variables, the ARDL technique was applied. Between variables, a long run cointegrated relationship has been discovered. Energy consumption has a significant effect on economic growth, demonstrating the necessity of energy. Economic growth is also fueled by financial development.

Tamazian et al. (2009) investigated whether rapid financial development and economic growth may contribute to environmental degradation in the BRIC countries. Panel data for the years 1992 to 2004 were available in the EKC literature. The study's aim was to explore the relationship between economic growth, financial development, and energy consumption in order to determine whether these factors lead to environmental degradation. CO2 emissions refer to a country's CO2 emissions per capita, whereas GDP refers to a country's GDP per capita. Economic growth and financial development were suggested as indicators of environmental effect in BRIC countries.

According to Kakar, Khilji, and Khan (2011), there is an association between financial development and energy consumption in Pakistan. The Granger Causality test was used to establish causality between financial development and energy consumption. The data was gathered between 1980 and 2014. While financial development has a long-term effect on energy consumption, it has little effect in the short term. As a result, financial development should be considered as a critical component in resolving energy issues.

Shahbaz (2013) examines the relationship between CO2 emissions, economic growth, financial development, energy consumption, and population growth in Pakistan. From 1974 to 2009, data were gathered using the World Development Index. Economic growth, financial development, energy consumption, population, and CO2 emissions all have a long-term relationship in Pakistan, according to the study. Environmental deterioration can be addressed through performance-driven financial development.

Shahbaz, Tiwari, and Nasir (2013) investigated the effect of financial development and energy consumption on Pakistan's CO2 emissions from 1971 to 2011. The World Development Index (WDI) online database was used to compile the time series data. The findings indicated that increasing CO2 emissions initially resulted in an increase in wages, but the relationship then shifted. The findings indicate that financial development improves along with environmental quality. Income, energy consumption, and financial development all contribute to Pakistan's CO2 emissions. The trade openness component had no effect on Pakistan's short- or long-run CO2 emissions.

Hossain and Hasanuzzaman (2014) conducted an investigation to analyze the relationship between CO2 emissions, energy consumption, economic growth, urbanization, financial development, and trade openness in Bangladesh using the Auto Regressive Distributed Lag (ARDL) testing technique. The coefficients for energy consumption and urbanization were both positive and significant, indicating that urbanization and energy consumption are to responsible for Bangladesh's rising CO2 emissions. On the other side, it has been demonstrated that real per capita GDP growth reduces per capita CO2 emissions. While, there is insufficient evidence linking CO2 emissions with financial development or openness of trade. Kakar et al. (2011) examined the relationship between energy consumption, economic growth, and financial development in Pakistan from 1980 to 2014 by employing co-integration and error correction approaches. The Granger causality test was used to determine the causal relationship. Financial development, the findings indicate, may be a successful way for resolving energy challenges through energy efficiency.

Odhiambo (2012) established a causal link between CO2 emissions and financial development in South Africa using the ARDL-Bounds test technique. In South Africa, empirical evidence indicates that a unidirectional causal connection exists between financial development and CO2 emissions. According to the study, energy consumption contributes to both carbon emissions and financial development. They proposed that the government do research into sustainable forms of renewable energy as well as energy saving programs in order to reduce carbon emissions without harming development.

Ozturk and Salah Uddin (2012) examined the Granger Causality relationship between energy consumption, carbon dioxide emissions, and financial development in India from 1971 to 2007. The most fundamental finding was that energy consumption and financial development are reversible in India; higher rates of financial development result in higher levels of energy consumption, and vice versa. İmamoğlu (2013) used the Environmental Kuznets Curve hypothesis to examine the empirical relationship between CO2 emissions and financial development. According to Time Series and Panel Data estimates, CO2 emissions in developing and developed countries are in long-run equilibrium, although the trade and financial institutions have a significant impact on CO2 emissions.

M. J. Alam, Begum, Buysse, Rahman, and Van Huylenbroeck (2011) evaluated the causal relationship between energy consumption, CO2 emissions, and revenue in India using a dynamic modeling method. In the long run, the results reveal a bidirectional causal relationship between energy consumption and CO2 emissions, with neither CO2 emissions nor energy consumption causing fluctuations in real GDP. Shahbaz, Solarin, et al. (2013) examine the co-integration between financial development and CO2 emissions in Malaysia. According to the data, significant long-run correlations have been established between CO2 emissions, financial development, energy consumption, and economic growth. The data indicate that while financial development reduces CO2 emissions, energy consumption and economic growth increase them.

Bella, Massidda, and Mattana (2014) examined the quadratic relationship between CO2 emissions, GDP levels, and electric power consumption using the panel vector error correction model. They detected in the data two unique long-term relationships. They begin by classifying nations according to the sign of the estimated coefficients, as the null of homogeneity across units in terms of long-run elasticities has been categorically rejected. This method is broken into three sections: the first contains evidence for a favorable scenario in which CO_2 emissions and electric power consumption are gradually reduced. On the other hand, the second cluster revealed a U-shaped pattern in the long-term relationship between income and electric power consumption, which was a positive indicator for emissions reduction. Finally, the third cluster is associated with a very worrying scenario in which per capita CO_2 emissions are expected to increase along with economic growth.

3. Data And Methodology

In the instance of Pakistan, this research examined the effect of financial development on the environment from 1980 to 2014. Secondary time series data were gathered from WDI and the Pakistan Handbook of Economic Statistics. As an independent variable, the financial development index is utilized. It is composed of domestic credit in the private sector, aggregate market capitalization, and net flow foreign direct investment. While carbon dioxide CO_2 emissions are used as the dependent variable. Additionally, economic growth, population density, and trade variables are included in the analysis. The following variables are included:

$$CO_2 = F\ (FD,\ GDP,\ POPULATION,\ TRADE) \qquad (1)$$

$$EC = F\ (FD,\ GDP,\ POPULATION,\ TRADE) \qquad (2)$$

3.1. Carbon Dioxide Emission (CO2)

Carbon dioxide emissions come from a number of sources, plus the combustion of fossil fuels and the manufacturing of cement. CO_2 is created as a result of the combustion of solid fuels, liquids, and gases. Here is taken out the release of carbon dioxide in (kt).

3.2. Energy Consumption (EC)

Energy consumption is used as an environmental indicator in this study. Energy consumed by a process or system, as well as an organization or community. Here energy consumption is taken in present of total.

3.3. Independent Variables

3.3.1. Financial Development Index

This analysis included the following major factors of the financial development.

3.3.2. Domestic Credit for Private Sector

Domestic credit given by financial sector contains all credit to different sectors on a gross basis, except for credit to the government, which is net. Monetary authorities and deposit money banks, as well as other financial businesses, make up the financial industry (Muhammad, 2012).

3.3.3. Market Capitalization of Ordinary Shares

The current share price is multiplied by the total number of outstanding shares to establish a company's market capitalization. It's computed by dividing the current market price of the company's stock by the total number of outstanding shares. A. Alam et al. (2015) uses the market capitalization of ordinary shares in million rupees as a financial development indicator.

3.3.4. Foreign Direct Investment (FDI) Net Flow

FDI is trans-border investment in which a local of one nation has control or a significant degree of influence over the administration of a business in another economy. The presence of a direct investment is established by the holding of more than 10% ordinary shares of voting stock in the company. The statistics are in U.S. dollars. Shu-Chen C (2015) uses net flow foreign direct investment as a financial development indicator.

3.3.5. Per Capita GDP

GDP per capita is taken as independent variable. And it is the proxy to the economic growth of a country which is taken in constant US$.

3.3.6. Population Density

The population density is calculated by multiplying the midyear population by the land area in square kilometers. Population is computed using the de facto definition, which includes all inhabitants regardless of legal status or citizenship, with the exception of refugees who are not permanently living in the country and are generally included in the population of their country of origin. The overall area of a country, excluding territory beneath inland water bodies, national claims to the continental shelf, and exclusive economic zones, is known as its land area.

3.3.7. Trade

Trade is the total of import and export of goods and services restrained as a share of gross domestic products. Trade is taken in present of GDP.

3.4. Model Specification

$$\Delta\ln(CO_2) = \alpha_0 + \sum_{i=1}^{p}\alpha_1\Delta\ln(FD)_{t-1} + \sum_{i=0}^{p}\alpha_2\Delta\ln(GDP)_{t-1} + \sum_{i=0}^{p}\alpha_3\Delta\ln(Population)_{t-1} + \sum_{i=0}^{p}\alpha_4\Delta\ln(Trade)_{t-1} + \gamma_1\ln(CO_2) + \gamma_2\ln(FD)_{t-1} + \gamma_3\ln(GDP)_{t-1} + v_i \quad (3)$$

$$\Delta\ln(EC) = \alpha_0 + \sum_{i=1}^{p}\alpha_1\Delta\ln(FD)_{t-1} + \sum_{i=0}^{p}\alpha_2\Delta\ln(GDP)_{t-1} + \sum_{i=0}^{p}\alpha_3\Delta\ln(Population)_{t-1} + \sum_{i=1}^{p}\alpha_4\Delta\ln(TRADE)_{t-1} + \gamma_1\ln(CO_2) + \gamma_2\ln(FD)_{t-1} + \gamma_3\ln(GDP)_{t-1} + v_i \quad (4)$$

3.5. Econometrics Methodology

The study uses a novel method known as Auto Regressive Distributed Lag (ARDL) to discover the long and short run relationships between the variables under question. The approach was used by (Pesaran, 1997; Pesaran, Shin, & Smith, 1999; Pesaran & Smith, 1998). When compared to other co-integration approaches, the ARDL methodology has the following advantages. I Even with a tiny sample size, the ARDL method produces reliable findings. (ii) Whether the variables are I(0), I(I), or mutually integrated, the ARDL form is acceptable. However, none of the variables are I(2) or higher order integrated. (iii) The ARDL method accounts for the issue of endogeniety (iv) Within the general –to-specific frame, the unconstrained model of error correction Model (ECM) captures adequate delays in data generation method. Other co-integration approaches cannot accept as many variables as the ARDL methodology (Afzal, Rehman, Farooq, & Sarwar, 2011). Even when certain regressors are endogenous, the ARDL generally yields neutral estimates of the long-run model and supports the-t-statistics (Bhatta, 2011).

The first step in utilising the ARDL co-integration technique is to define the order of integration of all variables. Because the study uses secondary time series data, it is necessary to consider variable characteristics using the unit root test. When using time series data for regression analysis, the underlying data must be stationary. If a time series is non-stationary, it can only be analyzed for the time period in question.

As a result, it's unlikely that it can be applied to other time periods. As a result, a unit root test is required. The unit root test is a prerequisite step in economics empirical analysis, particularly for the co-integration test. The findings are derived by assuming the null hypothesis has a unit root (non-stationary) and the alternative hypothesis has no unit root (stationary). The study used the Augmented Dickey Fuller (ADF) test of unit root to get its result, which was based on McKinnon's critical value and computed statistic.

4. Results and Discussions

All variables are stationary at I(0) and I(I), so ARDL approach to co-integration is employed. As it is required before applying ARDL that all variables should be integrated of order I(0) and I(I)and none of the variables should be integrated of higher order.

Table 1
ADF Results of Financial Development and Environment

Dependent Variables	Level P values	1st Difference P values	Conclusion
CO_2	0.8986	0.0000	I(1)
Energy Consumption	0.1345	0.0010	I(1)
	Independent Variables		
Population	0.0000	0.3456	I(0)
GDP	0.2584	0.0060	I(1)
FDI	0.0254	0.4510	I(0)
Trade	0.1058	0.0000	I(I)

Table 2
Level of Relationship with ARDL Model Test

F-Statistic	95% Lower boundary	95% Upper boundary	90% Lower boundary	90% Upper boundary
6.45789	3.23	4.35	2.72	3.77

The estimated value of t-static in the ARDL model is 6.45789, which is higher than the upper bound critical value at the 5% level of significance, indicating that the null hypothesis of no co-integration is rejected and the variables are related.

Table 3
Estimated Long Run co-efficient Results using the ARDL Approach

Variable	Coefficient	Std. Error	t-Statistic	Prob **
GDPPC	-1.681223	0.296311	5.67386	0.0001**
INDEX1	0.085911	0.012410	6.922443	0.0000**
POP15-64	10.236402	1.751958	5.842836	0.0001**
TO	1.125340	0.184059	6.114007	0.0001**
C	-20.61515	3.160428	-6.5214320	0.0000**

** indicates significance at 1% level of significance

The results show that all independent variables of financial development including GDP, population density and energy consumption has significant effect on CO2 emission.

Table 4
Short-run estimated ECM Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.**
GDPPC	0.261332	0.122969	2.125193	0.0571**
INDEX1	0.013084	0.002972	4.402060	0.0011**
POP15-64	4.916765	3.384368	1.452787	0.1742**
TO	0.234553	0.080936	2.898024	0.0145*
ECM(-1)	-0.430404	0.082005	-5.248514	0.0003**

** indicates significance at 1% level of significance

The findings reveal that foreign direct investment, GDP, and population density all have a favorable effect on carbon dioxide emissions. The ECM coefficient is -0.87125, implying that the long-run departure from equilibrium is rectified by 87 percent during the next several years.

4.1. CO2 and Financial Development (FD)

The statistics indicate that financial development has a positive impact on Pakistan's CO2 emissions. In the short and long run, 1% increase in financial development results an increase in carbon dioxide emissions of 26.13 percent and 8.591 percent, respectively. It is significant statistical at a 1% level of significance. Financial development results in an enhance in carbon dioxide emissions for the following reasons: First, the growth of the stock market enables publicly traded companies to reduce financing costs, expand financing channels, spread operating risk, and optimize asset/liability structures, allowing them to acquire new installations and invest in new projects, thereby increasing energy consumption and carbon emissions. Second, financial development attracts foreign direct investment, which boosts economic growth and hence reduces carbon dioxide emissions. Earlier, similar findings were made by (Shahbaz, 2013). It is proposed that the banking sector lend money to companies developing energy-efficient technologies. These findings contradict Shahbaz's earlier conclusions. According to (M. J. Alam et al., 2011), there is a negative correlation between financial development and CO2 emissions. Additionally, numerous other scholars have examined the influence of financial development on CO2 emissions including (Dasgupta et al., 2001; Frankel & Romer, 1999; Zhang, 2011), who claim that financial development enhances CO2 emissions.

4.2. CO_2 and Population Density

The results showed that population density has a positive and significant impact on CO2 emissions, with a 1% enhance in population density resulting in a 10% increase in CO2 emissions in Pakistan. It is significant statistically at a 1% level of significance. Population growth has an effect on fossil fuel consumption since it raises energy demand for power generation, industry, and transportation, which results in a rise in CO2 emissions (Birdsall, 1992). Thus, population density has an effect on energy consumption and CO2 emissions.

4.3. CO_2 and Economic Growth

The findings establish that economic growth has a negative impact on CO2 emissions. In the long and short run, a 1% increase in economic growth results in CO2 emissions reductions of 16.81 percent and 26.13 percent, respectively. It is statistically significant at a 1% level of significance. Pollution is inversely proportional to energy consumption, while increased energy consumption resulting in increased economic development and emissions of harmful gases. These findings contradict (Shahbaz, 2013) earlier findings Shahbaz, Solarin, et al. (2013), while consistent with the findings of (Ang, 2007; Apergis & Payne, 2009; Sharma, 2011).

4.4. Trade and CO_2 Emission

The findings showed that there is a positive correlation in trade and CO2 emissions in Pakistan. A 1% enhance in trade resulted in an increase in CO2 emissions of 11.25 percent in the short run and 43.04 percent in the long run, respectively. It has a statistical significance of 1% in the long run and 5% in the short term. The relationship between carbon emissions and foreign trade implies that while commodities are produced in one country, their consumption occurs in another, and so the intensity of a country's foreign trade may have contributed significantly to the amount of pollution in that country.

Table 5
Diagnostic tests

Test	Test Statistic
Serial correlation	0.1310
Normality	0.538791
Model Specification	0.3622

The diagnostic tests in above table shows that there is no problem of autocorrelation in this model. As ARDL assumption of normality is also fulfilled.

Table 6
Level of relationship existence with ARDL model test

F-Statistic	95% Lower boundary	95% Upper boundary	90% Lower boundary	90% Upper boundary
7.54739	2.79	3.67	2.37	3.2

In the ARDL model, the projected value of t-static is 7.54739, which is greater than the upper bound critical value at the 5% level of significance. The null hypothesis of no co-integration is rejected, suggesting a co-integration relationship between the variables.

4.5. Long Run Estimated Coefficients Results Using the ARDL Approach

The long run coefficients of the ARDL model are presented in the next step. Financial development has a favorable and considerable impact, according to the estimates.

Table 7
Results of Long Run Estimated co-efficient using the ARDL Approach

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
INDEX1	0.232329	0.070664	3.287798	0.00367**
GDPPC	0.293475	0.124923	2.349247	0.0324*
POP15-64	0.065701	0.307431	0.213709	0.56839
TO	0.232451	0.111763	2.079856	0.0019**
C	-2.461365	2.734136	-1.002406	0.3261

** indicates significance at 1% level of significance

The finding showed that all independent variables of financial development including GDP and population density has positive impact on Energy consumption.

Table 8
Short run Estimated Model ECM

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
INDEX1	0.194364	0.059687	3.256387	0.0037**
GDPPC	0.312818	0.136138	2.297802	0.0289**
POP15-64	-0.216853	0.401131	-0.540603	0.5395
TO	0.313284	0.127137	2.4641449	0.0067**
ECM(-1)	-0.587895	0.196775	-2.987650	0.01978**

** indicates significance at 1% level of significance

The error correction term is significant with a negative sign showed the speed of adjustment from short run to long run equilibrium. The results suggest that FDI, GDP and population density positively impact the energy consumption in short run while population density negatively impact the energy consumption which is insignificant. The coefficient of ECM is -0.636895 suggests deviation from equilibrium long run path is corrected by 63% over the following years. This shows the adjustment is very quick.

4.6. Energy consumption and financial development

The findings indicate that financial development has a significant effect on energy consumption. A 1% enhance in financial development increases energy consumption by 19.43 percent and 23.23 percent, respectively, in the short and long run. It is significant at a 1% level of significance. As financial growth improves, consumers and businesses may save, invest, and borrow money. Consumers can acquire high-ticket items such as automobiles or houses, which results in an increase in energy consumption. Similarly, it improves businesses' access to money, whether through decreased borrowing costs or new sources of funding such as equity financing, enabling them to expand operations while increasing energy consumption (Zhang, 2011). According to Tamazian et al. (2009) and Claessens and Feijen (2007), financial development may improve energy efficiency while lowering energy consumption and carbon emissions.

4.7. Energy consumption and GDP

The findings indicate that GDP has a significant effect on energy consumption in the short and long run. In the short and long run, a 1% rise in economic growth results in rise in energy consumption of 31.28 and 29.34 percent, respectively. At a 5% level of significance, it is statistically significant. Energy enables rapid expansion of total production. Energy is also required to alleviate poverty. Increased energy means that there is ample availability to water and electricity, both of which are required for growth. The panel causality test results indicate that for low-income countries, there is long-run causality in GDP and energy consumption and bidirectional causality between energy consumption and GDP for middle-income nations. GDP is taken as a proxy for economic growth in this case.

4.8. Trade and Energy Consumption

The results show positive impact of trade in short run and long run. 1% increase in trade will cause 23.24% and 31.32% increase in energy consumption in short and long run respectively. It is statistically significant at 1 % level of significance. Trade openness allows items produced in one country to be transported to another for consumption or further processing. It is impossible to manufacture those things without making appropriate use of energy. As a result, increased energy consumption will be necessary to support increased commercial activity. Similar findings are stated by (Narayan & Smyth, 2009; Sadorsky, 2010).

Table 9
Diagnostic Tests

LM Version	Test Statistic
Serial correlation	0.7416
Normality	4.785806

The above diagnostic test is showing no problem of autocorrelation in this model. ARDL assumption of normality is also fulfilled.

Table 10
Causality results Financial Development cause Co2

Hypothesis	P values
CO2 does not Granger Cause INDEX1	0.1843
INDEX1 does not Granger Cause CO2	0.0194

Granger causality test has been employed to check causality between financial development index and environment. It confirms that CO2 does not cause financial development as p value is insignificant. While financial development cause CO2 emission as p value is significant. Moreover, null hypothesis is rejected and alternate hypothesis is accepted which shows unidirectional causality between environment and financial development in Pakistan.

5. Conclusion and Recommendations

This research investigated the link between financial development, environment, and other economic aspects in Pakistan, like economic growth, trade, and population density. Additionally, it used the ARDL technique to investigate the short and long term correlations among variables of interest in Pakistan. For the years 1980 to 2014, the study made use of time series data from the World Development Indicators and Pakistan's statistical economic handbook. The findings indicate that financial development has a positive effect on CO2 emissions in the long and short run. Prior research on the association between carbon emissions and foreign trade had focused on the fact that products manufacturing generates pollution that is consumed by another country. This reaffirms the positive correlation between CO2 and financial development. Economic growth and population density have a beneficial impact on Pakistan's CO2 emissions. Similarly, trade has a positive effect on CO2 emissions. In the second model, financial development has a significant and positive effect on Pakistan's energy consumption.

Economic growth has a positive effect on energy consumption as well. As the population grows and the standard of living rises, the way energy is used changes as well. Additionally, increased trade results in increased energy consumption. Granger causality is also examined between the environment (CO2) and Pakistan's financial development. Whereas the results indicate rejection of Ho and acceptance of H1, respectively, indicating a causal relationship between the environment and financial development in Pakistan.

5.1. Recommendations

1. Governments of Pakistan should have to make proper environmental laws so CO_2 emission may not increase due to increase financial development in Pakistan.
2. Federal government mandates to take corrective action to reduce carbon emissions. It may be done directly through a carbon tax, which is an excellent technique for charging firms, factories, and industries directly depending on the quantity of carbon

they emit into the environment, as well as efficient transportation fuel usage. A carbon tax's purpose would be to persuade corporations and other organizations to cut their overall emissions.

3. In Pakistan there should be adopted technological innovation so that CO_2 emission reduce due to increase financial development.

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