Bulletin of Business and Economics, 12(3), 601-611
https://bbejournal.com
https://doi.org/10.61506/01.00077

Impact of Economic Growth, Renewable Energy, Net Exports, Labor Force and Life Expectancy on CO2 Emission

Shah Rukh Khan[1], Ufaq Adeel[2]

Abstract
An immense collection of information about the connection between energy utilization and CO2 outflows is covered by various factors. We have utilized the factors for example Kuznets bend, future, workforce, CO2 emanation, and environmentally friendly power. Nonetheless, the job of energy creation in the contamination condition remains generally obscure. Current work measures the connection between environmentally friendly power creation, financial development, CO2 emanations, Kuznets bend, workforce, and future. A group of econometric instruments is utilized to accomplish the target of the review. Because of the awareness of the target of the current work, we utilize the unit root test to gauge the security of the boundaries over the period 1991-2021(30 years of information) which we took from the World Bank marker. An autoregressive distributive slack model shows that energy creation from petroleum products is the primary guilty party behind rising CO2 discharges. Moreover, the discoveries of the review state the presence of natural Kuznets bends speculation in the significance of energy creation in Pakistan. It is proposed that contamination can be decreased by creating energy from inexhaustible sources (hydroelectric, sun-oriented, geothermal, and wind energy) and adding more sustainable power to the energy blend.
Keywords: Economic Growth, Renewable Energy, Net Exports, Labor Force, Life Expectancy, CO2

1. Introduction

The impact of exchange and financial development on climate have been talked about broadly in various monetary examinations. They have been tried under the structure of a natural Kuznets bend, which shows a rearranged U-molded connection between ecological contamination and pay per capita. A few signals that changes in the natural circumstances have likewise been made over the most recent 10 years to consolidate ecological factors in the public records. Early examinations in the EKC setting by Grossman and Krueger (1993 and 1995), Selden and Melody (1994), Vincent (1997), and Hurricane and Mendez (1998) zeroed in on the impacts of monetary development on ecological debasement. Be that as it may, these examinations have been reprimanded in light of multiple factors (for example Bolt et al., 1995; Harsh et al., 1996; Ekins, 1997; Harsh and Normal, 2001; Harsh, 2004; Audi and Ali, 2022; Audi et al., 2023). This fixation might prompt the distortion that any remaining poisons have a similar relationship to pay. Second, the connection between the climate and pay development might fluctuate by kind of revenue development because various sorts of financial action have different contamination forces. An understanding of this idea depicted by Antweiler et al. (2001) is that the contamination outcomes of monetary development rely upon the hidden wellspring of development. In this manner, on the off chance that non-industrial nations follow an alternate example of improvement, they may not follow a similar EKC way as industrialized nations. (2000) showed the way that systemic decisions can fundamentally influence results. Gross and Krueger (1995) distinguished that the nature of the climate can be impacted by the 3 three unique channels/ways that shape the EKC: impact of scale, when the economy develops there is an expansion in the contamination, and last not the most un-the strategy impact and the arrangement. Here the piece's impact shows the construction changes conceived an offspring in the economy, taking to the different natural tension later on that may be 10 years or more. Another thing which made suspicion that the main job is played by the public tension on the public authority strategy and the making the utilizing of non-dirtied creation procedure by the businesses. This is made with the understanding that as the pay builds, the pay flexibility of the natural quality develops. Accordingly, after the essential benchmark of the degree of pay, the rich countries will in general be willing and ready to channel assets into ecological well-being and bigger natural qualities.

Quickly expanding energy utilization brings critical natural difficulties, for example, huge scope CO2 emanations, which are one of the primary drivers of environmental change. Because of the great natural and well-being worries of CO2 outflows, clean energy, for example, sustainable power is arising as a compelling option in contrast to customary petroleum derivatives (Wang et al. 2018). Environmentally friendly power sources have been recognized as a vital activity to diminish CO2 discharges and battle environmental change. Consideration of environmentally friendly power in the energy blend has turned into a significant piece of energy approaches all over the planet (Dong et al. 2018; Ali, 2022; Audi and Ali, 2023; Ashiq et al., 2023; Audi and Ali, 2023).

Pakistan has encountered high financial development throughout the course of recent many years. Its GDP (Gross domestic product) has developed from US$236.9 billion in 1980 to US$3049.5 billion in 2017 (World Bank 2017). Simultaneously, fast monetary development has expanded essential energy utilization with a typical yearly development pace of 13% (BP Factual Audit 2015). This rising energy utilization creates two significant issues in Pakistan: extreme energy emergency and tremendous CO2 emanations (Shoaib 2013). As needs be, there is a rising interest in controlling CO2 discharges from non-renewable energy source utilization in this country. With these developing worries, clean energy, for example, environmentally friendly power has become a piece of the energy blend in Pakistan as in numerous different nations.

Existing investigations play examined the part of inexhaustible and non-sustainable power utilization on CO2 outflows (Ito 2017; Zoundi 2016; Audi et al., 2020; Ali, 2022; Ali et al., 2022). They took a gander at the expected pay and sustainable power nexus and that environmentally friendly power and CO2 Between the discharges of Nonetheless, little writing researches the communication impacts between monetary development and environmentally friendly power utilization on CO2 emanations. This study endeavors to fill this hole by dissecting the connection impact of sustainable power and financial development on CO2

[1] Department of Economics, University of Lahore, Pakistan
[2] Department of Economics, University of Lahore, Pakistan

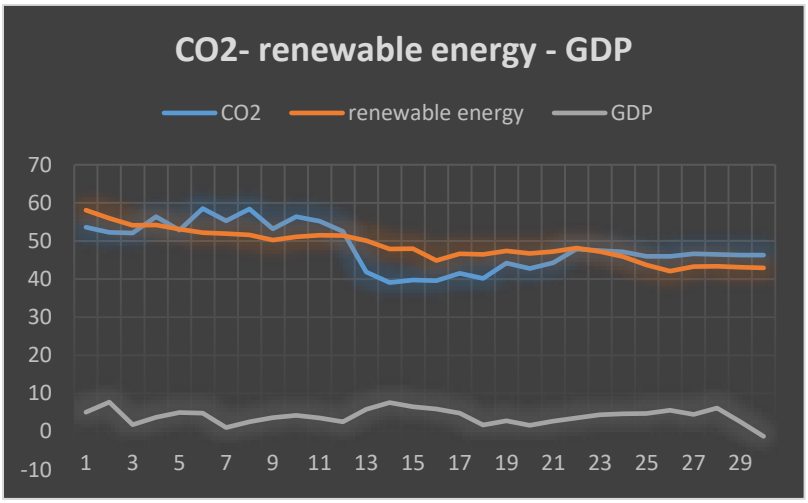
discharges considering non-environmentally friendly power, exchange receptiveness, and human resources in Pakistan. (2017a) who analyzed the job of a sustainable and non-environmentally friendly power in CO2 outflows found by discarding significant factors. This issue is covered by extra ward factors like exchange transparency, human resources, and the connection between monetary development and environmentally friendly power.

This study adds to the current writing in the accompanying three angles. In the first place, we observationally investigate the connection between financial development, environmentally friendly power utilization, and CO2 emanations. Second, we think about various potential factors in the examination structure. Existing investigations have dismissed potential factors that might add to determination predisposition. This work will help strategy creators in dealing with the weakness of Pakistan's economy because of expanding natural pressure and environmental change. Third, this study utilizes a three-stage concurrent (3SLS) condition model, rather than a covariance and causality approach that can manage the conceivable connection between's the regressor and the stochastic blunder term, and results (Bakhsh et al., 2017).

Expanded financial development and modern areas use energy for improvement which causes natural debasement. Pakistan is confronting immense energy interest for which regular energy sources are utilized to meet the quickly expanding energy interest. Wolde-Rufael and Menyah (2010) expressed that the utilization of ordinary energy sources causes the discharge of carbon dioxide which adds to the decay of natural quality. Ahmed et al. (2015) expressed that ecological debasement influences the climate and human wellbeing in Pakistan. Yang and Lee (2017) expressed that ecological debasement is brought about by the discharge of ozone depleting substances, including carbon dioxide, nitrous oxide and methane. Shahbaz and so on((2013) expressed that the utilization of petroleum derivatives for day to day existence, enormous scope smoke emanations from manufacturing plants and the utilization of wood as energy sources increment CO2 outflows. Carbon dioxide emanations devastatingly affect the economy and different areas like horticulture and ranger service.

Chaudhry (2010); Pao and Tsai (2010); Ahmad et al., (2022): Sajid and Ali (2018), Siddiqui (2004), Ali (2022) examined the connection between energy utilization, financial development, and manageable climate. The greater part of the explores have been finished for created nations like European nations and American nations (Kasman and Selman 2015). Early examination on a similar subject has commonly inferred that financial development and energy utilization cause CO2 discharges.

A few examination studies have distinguished the connection between financial development, non-sustainable power and CO2 outflows, which is vital to comprehend and further develop the improvement examples of emerging nations like Pakistan. Social orders that are wealthy in regular assets can actually decrease fossil asset imports and carbon dioxide outflows. Balsalobre et al. (2018) expressed that the execution of an energy technique has been approved to diminish reliance on the utilization of non-sustainable power sources. Non-environmentally friendly power sources actually firmly affect the energy blend. It characterizes the manageability of both energy sources, for example sustainable and non-sustainable which can be over the long haul. Different analysts have brought up that the utilization of non-sustainable power utilization and financial advancement in created nations prompts ecological debasement. This exploration study will assist with overcoming any issues between past investigations by controlling the model of energy utilization, monetary development, and CO2 outflows. This examination concentrate on utilized recently evolved econometric methods including autoregressive circulation slack (ARDL) headed testing for cointegration. The ARDL model enjoys a few upper hands over other intermingling techniques. The ARDL model can be applied assuming the factors are fixed at the level or both are first differenced while other covariance strategies require a similar request of reconciliation. Various slacks can be utilized for reliant and autonomous factors (Pesaran et al. (2001). This study gives another vision to strategy producers to configuration key approach instruments to adjust financial development and natural quality.



The graph shows the relationship between the CO2, renewable energy and GDP. The GDP trend shows that it is decreasing over the period. And the CO2 is showing the downward trend and the 3rd variable i.e. renewable energy is showing the constant decreasing trend.

2. Literature reviews

Abbasi and Jiao, (2020) stated in their article asymmetric impact of renewable and non-renewable energy on economic growth in Pakistan: new evidence from a nonlinear analysis. The introduction of this paper is that the heavy reliance of the world on non-renewable energy sources leads to serious worldwide concerns and problem, including potential depletion of non-renewable energy sources, energy security, and environmental issues. The variables are GDP, REC, NRE, and TA. It is noted that the long-term relationship between REC^{P}, REC^{N} and economic growth is asymmetric. It is found that GDP is growing by 0.36 due to the positive shock in REC^{P} while the negative shock in REC^{N} is growing by 0.62. The sign of both coefficients, however, is the same but different in magnitude, which indicates REC has a magnificent asymmetric impact on economic growth. This paper suggests that policy-makers should continue to encourage the generation and maintain the demand and supply of renewable energy Pakistan. Hence, Pakistan government should take into account economic growth's asymmetrical behavior.

Linda and Abdulai (2011) stated in their article the impact of trade and economic growth on the environment, revisiting the cross-country evidence. The effects of international trade and economic development on the environment have been widely discussed in economic literature. They have mostly been examined within the framework of an environmental Kuznets curve which postulates an inverted U-shaped relationship between environmental pollution and per capita income. The variables used are CFCPC, BOD, ENERGYPC, ANS, TRADE, TARIFF, EXPORT, IMPORT, GDP, GDPSQ, POPD. Autocorrelation was present in the first order, and the test for heteroscedasticity revealed the presence of heteroscedasicity. The result for the other specifications, feasible generalized least squares correcting for AR(1) and random effects , are not reported here but are available upon request. The recommended policy is that country can get a 'free ride' on the environmental efforts of others, and industries can avoid environmental regulations by moving to other countries, therefore, global pollution issues require international cooperative, action.

Rehan and khan (2020), stated in their article the relationship between energy consumption, economic growth and carbon dioxide emissions in Pakistan. In Pakistan there is rapid growth of industry and besides this, rapid increase in population causes deforestation; Pakistan is top ranked country in Asian countries that faces the problem of deforestation. Increase in economic growth and industrial sectors use energy for growth that causes environmental degradation. The variables used are CO_2 emission per capita, PCI, CLCNM, OLCNM, NTGCNM. Results of non-renewable energy consumption indicate a positive impact on environmental degradation in Pakistan. Economic growth indicates a positive effect on the degradation of the environment in Pakistan. It is average in developing countries economy when the economic growth increases, so it causes to raise the CO2 emissions in the economy because of the economic activities in shape of a considerable number of factories which cause CO2 emissions. Based on the results of this study, it is recommended that government of Pakistan should educate the local people to motive them toward plantation with forest department to increase the share of the forest to control environmental degradation in Pakistan. To control the environmental degradations in the long run, the policy makers are recommended to adopt such policies that encourage using environment-friendly equipment, machinery, vehicles, and utilities to minimize the environmental degradations.

Tauseef and Enjun and et al., (2019) stated in their article Natural resources, globalization, and economic growth: evidence from Pakistan. Globalization is a multidimensional phenomenon and increasingly a driving force behind vibrant economies around the world. Since the early twenty-first century, globalization has generated a new millennium of communication in all sectors, whether economic, political, or social. Now, the old adage that "the world is getting smaller" refers not only to increased ease of transportation and communication but also to international and cross-border market buying and selling of goods and services. The variables used are GDP, NR, GLOB, and URB. The unit root test shows the level of stationarity, an important step before confirming the co-integration between the variables. For instance, any integrated variable at order 2 indicates that the ARDL technique cannot be used. The Ng-Perron unit root test analysis confirms the level of stationarity. Since the results indicate that the variables are not integrated at order 2, the ARDL technique is appropriate for use in this study. The study's results suggest that the government of Pakistan should pay close attention to globalization, particularly regarding small businesses and illegal trade activities at the country's borders, which directly affect the country's exports. Moreover, institutional quality should be ensured by means of institutional reforms and policies, which will increase globalization and help the country's economic development. Improvements in legal systems, corruption, and the quality of financial information, prudent regulations, and supervision of the banking system could also help the country to increase globalization and financial development.

Gulzara and Muhammad and heaping and et.al (2018), stated in their article trade liberalization, FDI inflows economic growth and environmental sustainability in Pakistan and India. The trade liberalization and FDI lead to an expansion of international activities in energy consumption and manufacturing. As resultant the consumption of energy increased extremely. Especially in developing countries, these factors increased the weaknesses of the ecosystem. The variables used are GDP, CO2, Trade, FDI, and K. the results show that the coefficient of capital (lK) is positive and significant, which shows that in long run capital contribute to CO2 emission. As people invest more and more capital in business this will produce more output which in turn increase CO2 which cause environmental degradation in long run. The coefficient of income (GDP) is negative and significant at 1 percent. Which shows that a 1 percent increase in income can decrease in CO2 emission in long run. This reveals that at the initial stage of economic growth CO2 emission decreases and more growth leads to less CO2 due to the increase in business and job opportunities which cause environmental degradation or environmental instability. This study recommends the policymakers of both countries to promote green FDI and trade liberalization for the wellbeing of their citizens by giving more devotion to dramatic concerns of FDI and trade to decrease the CO2 in the environment. Countries can get benefit most from liberalizing their own markets than access to markets of other countries.

Zhaohua el.at (2019), stated in their article dynamic linkages among co2 emissions, health expenditures, and economic growth: empirical evidence from Pakistan. The most threatening danger to quality of life is the environmental degradation and the main

cause is greenhouse gas emissions. GHG emissions are increasing and creating an alarming situation for global warming as well as the climate system. Moreover, Apergis et al. added that severe type of expansion and emissions of GHGs on a continuous basis is a threat for environment and danger for human health. The best-known GHG stemmed from human activities is carbon dioxide, which is a great contributor to global warming and has adverse effects on human health. Therefore, the impact of negative externalities emanated from CO2 emissions on economic growth and human health cannot be disregarded. The variable used in paper are Health, CO2, GDP, Capital, and trade. The results reveal that the relationship between CO2 emissions and health expenditures is significantly positive. This coefficient states that when CO2 emissions rise, health expenditures also rise. The most important policy in this matter suggested that is to limit the carbon emissions. Pakistan, among the other countries and road countries, possess great potential of energy production and saving if it properly utilizes its natural resources.

2.1. Problem statement

Why the increase in CO2 shows negative effect on growth?

2.2. Objectives

The aim of this study is to show that:

- When the labor force decreases its shows negative impact on GDP
- When the negative net exports burden on the economy increases, it leads to the backwardness of economy
- When there is the increase in CO2 emission, this means that growth is increasing as industry is generating CO2 but CO2 effects the other factors too i.e. health, productivity and etc.
- When there is increase in life expectancy then there would be more labor force with more productivity to give input for the growth of country.
- The use of non-renewable energy i.e. fossils fuels are the main culprits for the damage of the environment failure.

3. Research Methodology

3.1. Data collection

Data is collected for the Pakistan from year 1991- 2020.

3.2. Source of data

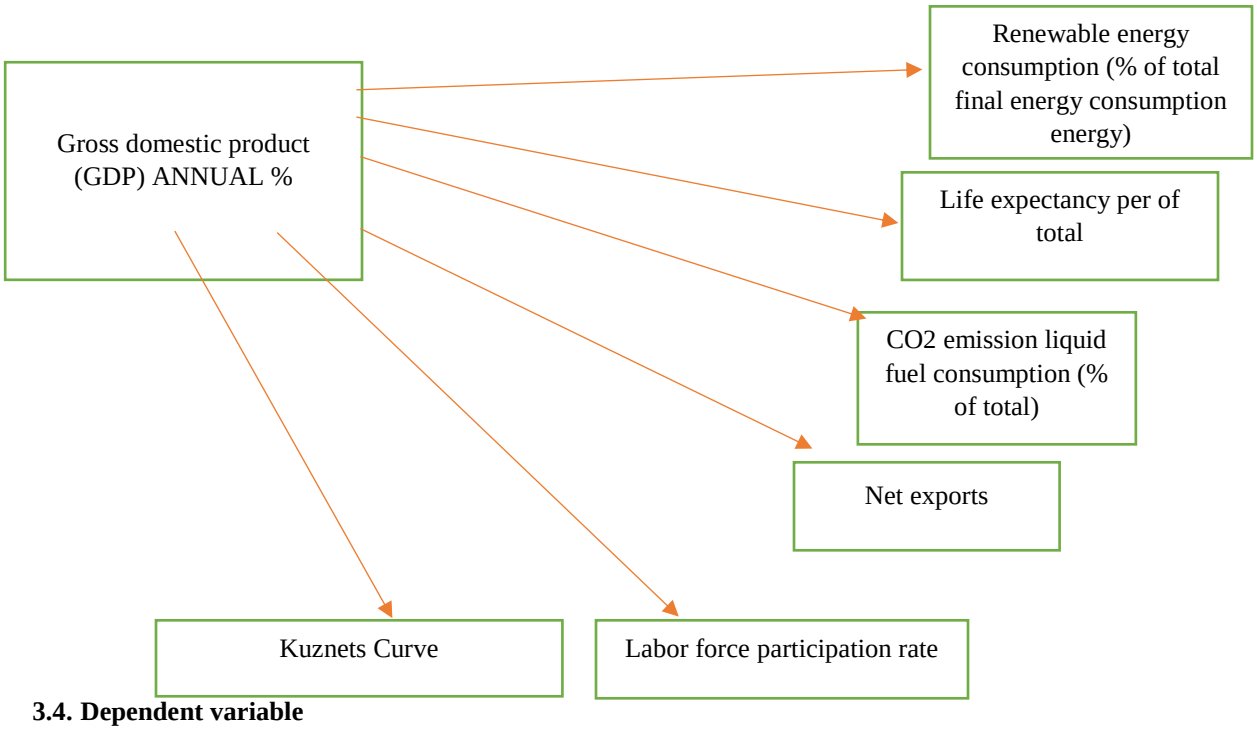
This data is collected from the World Development Indicators (WDI)

3.3. Type of study

A quantitative empirical analysis is conducted over the variables.

Following, Ali (2011), Ali and Ahmad (2014), Ali (2015), Ali and Ali (2016), Ali and Naeeem (2017), Senturk and Ali (2021), Audi and Ali (2016), Audi and Ali (2017), Ali et al., (2021), the conceptual model for our study become as:

Dependent variable **Independent Variable**



3.4. Dependent variable

- **Gross domestic product (GDP) ANNUAL %**

GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

3.5. Independent variable

- **Life expectancy per of total**

Refers to the number of years a person can expect to live.

Net exports:

The value of its total exports minus the value of its total imports. The figure also is called the balance of trade

- **CO2 emission liquid fuel consumption (% of total)**

Carbon dioxide emissions from liquid fuel consumption refer mainly to emissions from use of petroleum-derived fuels as an energy source.

- **Renewable energy consumption (% of total final energy consumption energy)**

Renewable energy consumption is the share of renewable energy in total final energy consumption.

- **Labor force participation rate**

Labor force participation rate is the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period.

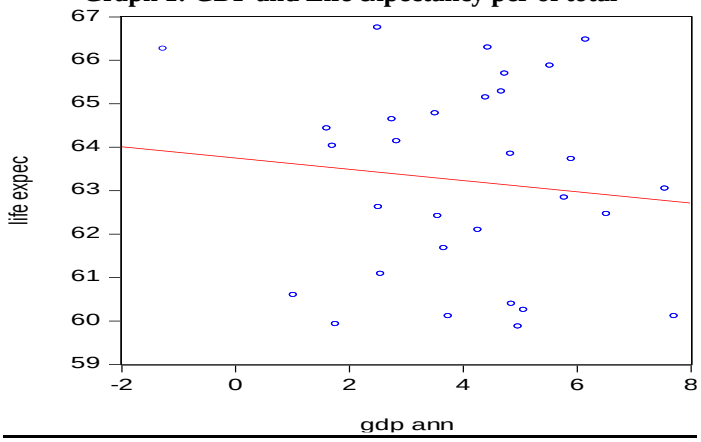
- **Kuznets Curve**

The Environmental Kuznets Curve (EKC) is often used to describe the relationship between economic growth and environmental quality. It refers to the hypothesis of an inverted U-shaped relationship between economic output per capita and some measures of environmental quality

3.6. Relationship between dependent variable and independent variables

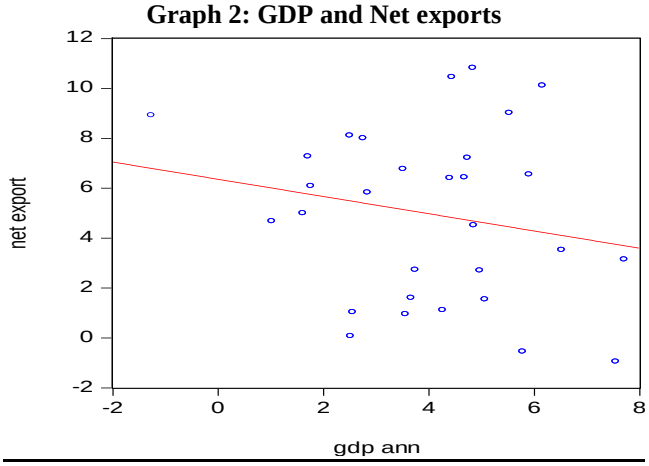
The relationship between GDP and export can be analyzed with the help of following graph 1:

Graph 1: GDP and Life expectancy per of total



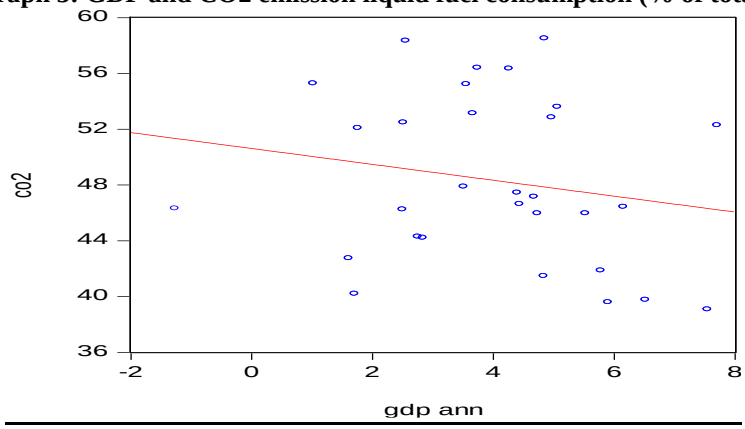
The relationship between GDP and Import can be analyzed with the help of following graph 2:

Graph 2: GDP and Net exports



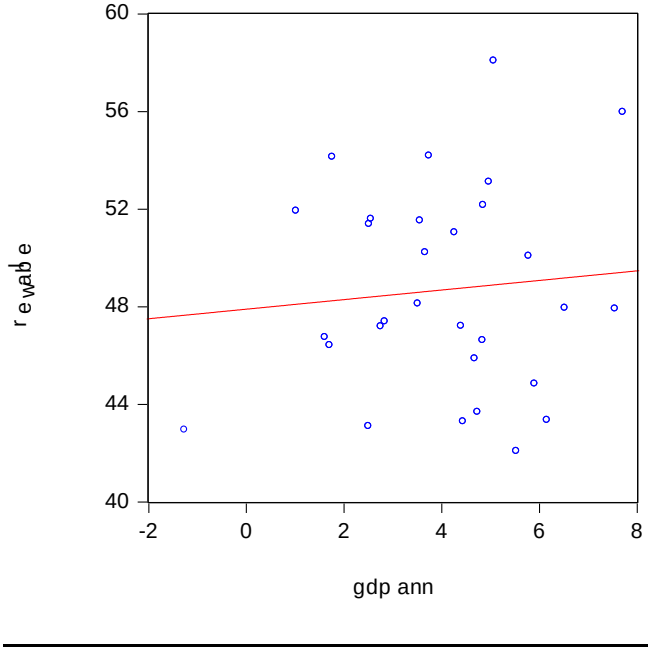
The relationship between GDP and CO2 can be analyzed with the help of following graph 3:

Graph 3: GDP and CO2 emission liquid fuel consumption (% of total)



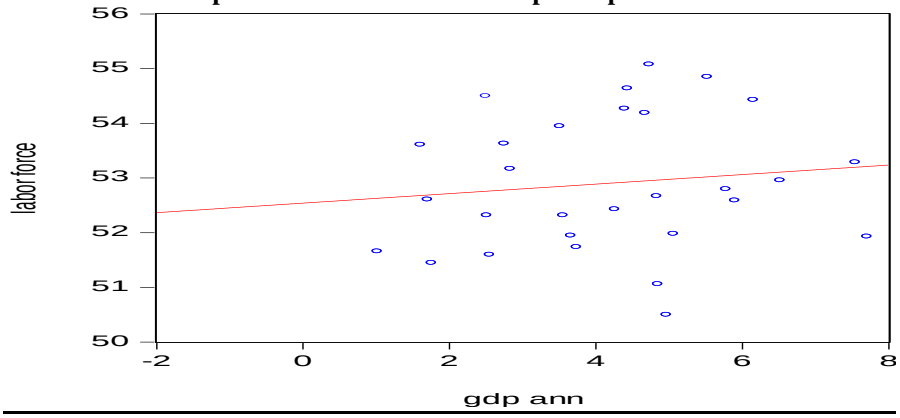
The relationship between GDP and renewable energy can be analyzed with the help of following graph 4:

Graph 4: GDP and Renewable energy consumption (% of total final energy consumption energy)



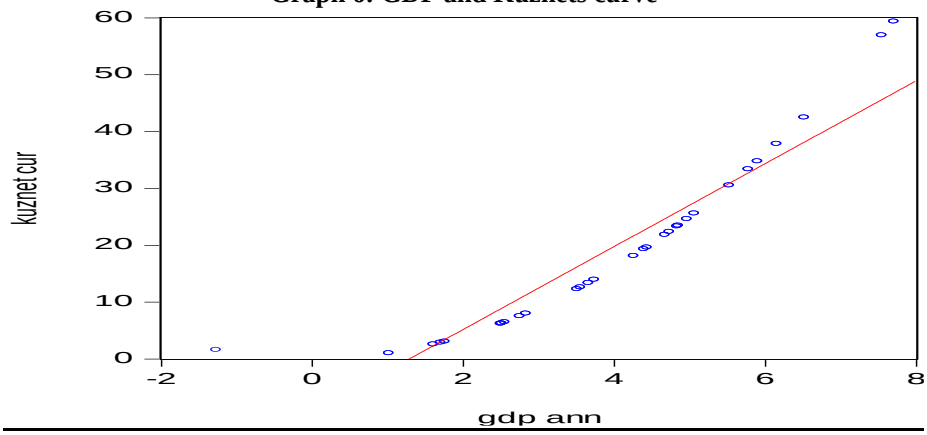
The relationship between GDP and Labor force participation rate can be analyzed with the help of following graph 5:

Graph 5: GDP and Labor force participation rate

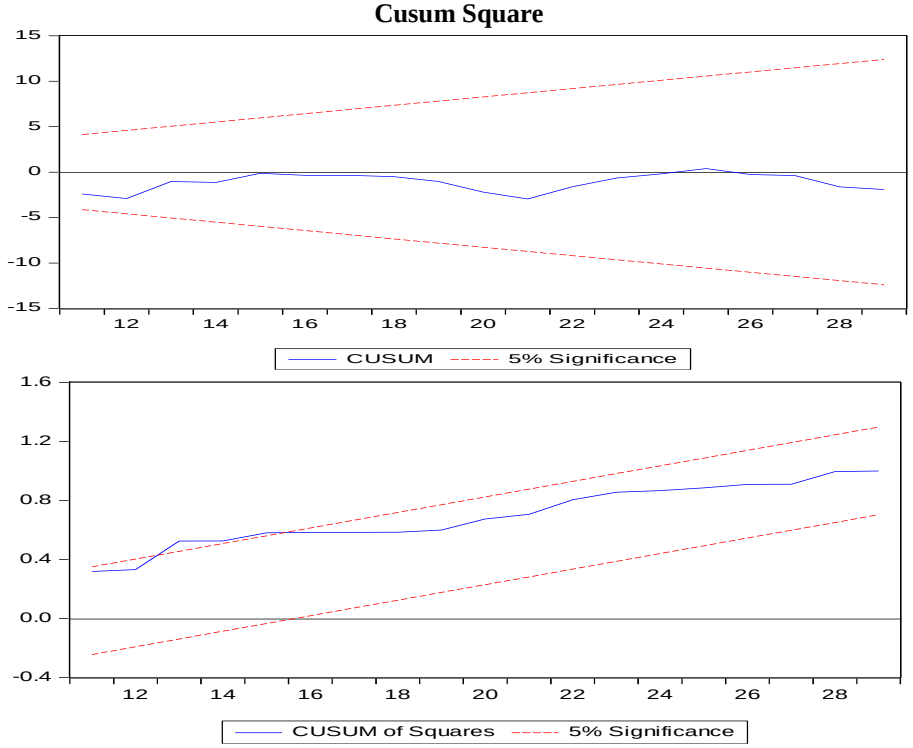


The relationship between GDP and Kuznets curve can be analyzed with the help of following graph 6:

Graph 6: GDP and Kuznets curve



Cusum Square



4. Theoretical model

VARIABLES	Data Source
Gross domestic product (GDP) ANNUAL %	WDI
Life expectancy per of total	WDI
Net exports	WDI
Labor force participation rate	WDI
Kuznets Curve	SQUARE OF GDP
CO2 emission liquid fuel consumption (% of total)	WDI
Renewable energy consumption	WDI

4.1. Econometric Model

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \mu$$

Y= GDP
X1= Life expectancy per of total
X2= Net exports

X3= CO2 emission liquid fuel consumption (% of total)
X4= Renewable energy consumption (% of total final energy consumption energy)
X5= Labor force participation rate
X6= Kuznets Curve

5. Econometric technique

5.1. Augmented Dickey–Fuller test (ADF)

This test is used to check the stationary of data. For augmented dickey fuller test Stata 10 is used to test unit root of each variable either at level without trend and intercept or with interceptand no trend or with both trend and intercept same is tested at first difference.

- With no intercept and no trend:

$$\Delta Y_t = \Upsilon Y_{t-1} + \Sigma \beta_i \Delta Y_{t-I} + \mu_t$$

- With intercept:

$$\Delta Y_t = \alpha 0 + \Sigma \beta_i \Delta Y_{t-I} + \mu_t$$

- With intercept a trend:

$$\Delta Y_t = \alpha 0 + \alpha 1_t + \Sigma \beta_i \Delta Y_{t-I} + \mu_t$$

5.2. Autoregressive Distributed Lag (ARDL)

ARDL model is an ordinary least square (OLS) based model which is applicable for both non-stationary time series as well as for times series with mixed order of integration.

$$\Phi(L)yt = \varphi + \theta(L)xt + ut,$$

6. Results and interpretation

Table 1: Results of ADF test

Variables	calculated value	critical value	probability	Level of integration
GDP	-6.4751	-2.9678	0	I (1)
CO2	-6.242	-1.9534	0	I (1)
kuznet curve	-2.1655	-1.9525	0.0313	I(0)
net exports	-4.207	-1.9529	0.0001	I(1)
RENEW	-5.4153	-2.9719	0.0001	I (1)

If the t-calculated is less than t-critical then we fail to accept H_0 either with no constant no trend with constant and no trend or with both constant and trend. Hence the variables (GDP, CO2, LIFE EXPENTANCY, NET EXPORT, RENEWABLE, LABOR FORCE) are stationary at level and 1st difference.

Table 2: Short Run Results

Variable	coefficient	prob.	
R-squared		0.970835	4.140662
Adjusted R-squared		0.958555	1.770772

In the above table 2 results of the short run, it is clearly seen that the value of R^2 is 97% which means that the independent variable explains 97% of the dependent variable.

If the life expectancy on GDP increases by 1% the GDP increases by 18% on average keeping the other variable constant. Its probability is 0.26 which is greater than 0.05 hence the impact is insignificant.

Kuznets curve on GDP

If the Kuznets curve increases by 1% the GDP increases by 10% on average keeping other variables constant. Its probability is 0.0000 which is highly significant.

Labor force

If the labor force increases by 1% the GDP will decrease by 23% on average keeping the other variables constant. Its probability is 0.2083 which has an insignificant effect.

Net export on GDP

If the net export increases by 1% the GDP will decrease by 0.01 on average keeping the other variable constant. Its probability is 0.6041 which is insignificant**.**

Renewable energy

If the renewable energy increase by 1% the GDP will decrease by 0.043 on average keeping the other variable constant. Its probability is 0.4551 which is an insignificant effect.

CO2 on GDP

If the CO2 emission increase by 1% the GDP will increase by 0.038 on average keeping the other variable constant. Its probability is 0.028 which is significant.

Table 3: Results of co-integration

Variable	Coefficient	Prob.
KUZNET_CUR	0.106249	0
Life expectancy	0.182388	0.2607
Labor force	-0.230315	0.2083
NET_EXPORT	-0.016056	0.6041
RENEWABLE	-0.043757	0.4551
CO2	0.038163	0.028
C	3.01062	0.726

Table 4: Results of autocorrelation tests

Test	calculated probability
breusch-Godfrey LM	0.4973

In the table4 results reveal Breusch-Godfrey LM can't reject the null hypothesis so there is no auto-correlation in this model.

Table 5: Heteroskedasticity results

Heteroskedasticity Test: Breusch-Pagan-Godfrey		
	Prob. F(8,19)	0.2503

In Table 5 the test can't reject the null hypothesis so there is no heteroskedasticity.

7. Discussion

ADF results show that there is a long-run relationship between the Net Exports, Kuznets curve, CO2 emission liquid fuel consumption (% of total) and Renewable energy consumption (% of total final energy consumption energy), labor force, and life expectancy at 5% of significance level.

Danish et.al (2018) Energy is a dilemma, and it needs to be addressed from different angles. This requires some innovative solutions beyond the current conventional thinking, considering environmental, social, and economic issues regarding technology implementation. The negative environmental impact of energy consumption has been the subject of discussion in earlier work. The majority of research work on energy–environment focuses on carbon dioxide emissions from energy consumption. However, the behavior of energy production in environmental quality has not yet been addressed. This is an important limitation and needs to be addressed. This present research work adds to the research line by investigating to validate the environmental Kuznets curve hypothesis in the importance of energy production. When this conclusion and the fact that there is evidence in favor of PHH for energy consumption and ANS are combined, production and consumption may differ in EKC for rich countries as Wagner (2007) suggested. The main part of the present study is to assess the relationship between energy production, economic growth, and carbon dioxide emissions incorporating urbanization and trade in the case of Pakistan over the period 1991-2021.ARDL technique is used to empirically test the relationship between the dependent and independent variables. An advanced accounting method is used to check the reliability of the results. Diagnostic tests are also used to test for serial correlation, and heteroskedasticity of the econometric model to ensure model stability. To summarize the findings of the study, it seems that increasing per capita income reduces carbon emissions in Pakistan. The results of our study confirm the hypothesis of ecological cousins, which provides policymakers with new insights into the importance of energy production. Secondly, this study draws on research to conclude that fossil fuel energy production is the main culprit behind rising carbon emissions in the country. Moreover, trade in the country helps reduce pollution. Hence, the trade ratio plays an important role in reducing carbon emissions over time. Interestingly, the trade does not emit CO2 into the atmosphere and is environmentally friendly. An interesting result is found for urbanization. It is argued that urbanization helps reduce CO2 emissions, and the link between urbanization and CO2 emissions is supported by predictions of ecological modernization theory. Following the findings of our study, Zhang et al. (2018) there is a need for policy action to increase the per capita GDP in Pakistan, which will help reduce pollution in the country.

8. Conclusion

The main objective of this paper is to examine the nexus between renewable energy, economic growth, CO2 emissions, labor force, life expectancy, and net exports in Pakistan from 1991 to 2021. The stationarity of each time series was checked by Augmented Dickey-Fuller (ADF). Augmented Dickey-Fuller (ADF) unit root test results indicated that the all-time series is stationary at the level and first difference and none of the series are stationary at the second difference. Autoregressive distributed lag (ARDL) is applied to test for collinearity between series.

8.1. Policy Recommendation

To the above results and connections among reliant and free factors, we recommend the strategy for our paper that the public authority ought to make a successful approach to decrease the outflow of CO2 by forcing charge on businesses and that enterprises can do specific level because the CO2 emanation impacts the efficiency of the workforce which in the end impacts the Gross domestic product to fall. The strategy creators ought to improve the sustainable items and advance it since it decidedly affects our Gross domestic product and shows a decent pattern in it. There is a negative net product of Pakistan so the public authority ought to diminish its import and increment its commodity and back the homegrown producer wherein they can completely use their assets and produce in which they enjoy outright benefit of it by this we can make increase in our Gross domestic product development. The government ought to accompany a powerful strategy to handle the CO2 outflow on account of the CO2 emanation the future abatements and individuals ordinarily don't have great and charming air to inhale which influences their well-being and diminishes their typical life age. The public authority ought to establish more plants so the impact of CO2 delivered by the enterprises makes less difference. By this, we will see a positive change in our Gross domestic product development and by that, we will be a created country.

8.2. Limitations

The present study has some limitations.

- First, the impact of energy consumption and energy production on CO2 emissions may differ. For future research, energy consumption and energy production can be studied together to examine the differences in the effects of energy production and energy consumption on CO2 emissions, providing more insight to policymakers.
- Second, disaggregated data on energy production (renewable energy and non-renewable energy) could be expanded through future research to assess which source contributes more to the pollution equation.

References

Abbasi K, Jiao Z, Shahbaz M, Khan A. (2020) Asymmetric impact of renewable and non-renewable energy on economic growth in Pakistan: New evidence from a nonlinear analysis. *Energy Exploration & Exploitation*, 38(5), 1946-1967.

Abbasi.K & Jiao.Z, (2020). Asymmetric Impact of renewable and non-renewable energy on economic growth in Pakistan: new Evidence from the nonlinear analysis, *SAGE journals*, 38(5), 1-22

Ahmad, K., Ali, A., & Yang, M. (2022). The Effect of Trade Liberalization on Expenditure Structure of Pakistan. *Bulletin of Business and Economics (BBE)*, *11*(1), 73-84.

Ali, A. & Naeem, M.Z. (2017). Trade Liberalization and Fiscal Management of Pakistan: A Brief Overview. *Policy Brief-Department of Economics, PU, Lahore*. 2017 (1), 1-6.

Ali, A. (2011). Disaggregated import demand functions of Pakistan; An empirical Analysis. M-Phil Thesis, NCBA&E, Lahore, Pakistan, 1-70.

Ali, A. (2015). *The impact of macroeconomic instability on social progress: an empirical analysis of Pakistan*. (Doctoral dissertation, National College of Business Administration & Economics Lahore).

Ali, A. (2022). Determining Pakistan's Financial Dependency: The Role of Financial Globalization and Corruption. *Journal of Business and Economic Options*.

Ali, A. (2022). Financial Liberalization, Institutional Quality and Economic Growth Nexus: Panel Analysis of African Countries. *Bulletin of Business and Economics (BBE)*, *11*(3), 37-49.

Ali, A., & Ahmad, K. (2014). The Impact of Socio-Economic Factors on Life Expectancy in Sultanate of Oman: An Empirical Analysis. *Middle-East Journal of Scientific Research*, 22(2), 218-224.

Ali, A., & Audi, M. (2016). The Impact of Income Inequality, Environmental Degradation and Globalization on Life Expectancy in Pakistan: An Empirical Analysis. *International Journal of Economics and Empirical Research*, 4 (4), 182-193.

Ali, A., Audi, M., & Roussel, Y. (2021). Natural Resources Depletion, Renewable Energy Consumption and Environmental Degradation: A Comparative Analysis of Developed and Developing World. *International Journal of Energy Economics and Policy*, *11*(3), 251-260.

Ali, A., Audi, M., Bibi, C., & Roussel, Y. (2021). The Impact of Gender Inequality and Environmental Degradation on Human Well-being in the Case of Pakistan: A Time Series Analysis. *International Journal of Economics and Financial Issues*, *11*(2), 92-99.

Ali, A., Audi, M., Senturk, I., & Roussel, Y. (2022). Do Sectoral Growth Promote CO2 Emissions in Pakistan? Time Series Analysis in Presence of Structural Break. *International Journal of Energy Economics and Policy*, *12*(2), 410-425.

Ashiq, S., Ali, A., & Siddique, H. M. A. (2023). Impact of Innovation on CO2 Emissions in South Asian Countries. *Bulletin of Business and Economics (BBE)*, *12*(2), 201-211.

Audi, M & Ali, A. (2017). Socio-Economic Status and Life Expectancy in Lebanon: An Empirical Analysis. *Archives of Business Research*, 5(11), 159-170

Audi, M. & Ali, A. (2017). Environmental Degradation, Energy consumption, Population Density and Economic Development in Lebanon: A time series Analysis (1971-2014). *Journal of International Finance and Economics*, 17(1), 7-20.

Audi, M. & Ali, A. (2023). Unveiling the Role of Business Freedom to Determine Environmental Degradation in Developing countries. *International Journal of Energy Economics and Policy*, 13(5), 157-164.

Audi, M., & Ali, A. (2016). A Causality and Co-integration Analysis of Some Selected Socio-Economic Determinants of Fertility: Empirics from Tunisia. *Bulletin of Business and Economics (BBE)*, 5(1), 20-36.

Audi, M., & Ali, A. (2023). The role of environmental conditions and purchasing power parity in determining quality of life among big Asian cities. *International Journal of Energy Economics and Policy*, *13*(3), 292-305.

Audi, M., Ali, A., & Hamadeh, H. F. (2022). Nexus Among Innovations, Financial Development and Economic Growth in Developing Countries. *Journal of Applied Economic Sciences*, *17*(4).

Audi, M., Ali, A., & Kassem, M. (2020). Greenhouse Gases: A Review of Losses and Benefits. *International Journal of Energy Economics and Policy*, *10*(1), 403.

Audi, M., Ehsan, R., & Ali, A. (2023). Does Globalization Promote Financial Integration in South Asian Economies? Unveiling the Role of Monetary and Fiscal Performance in Internationalization. *Empirical Economics Letters*, 22(10), 237-248.

Danish, Zhang, B., Wang, Z. (2018). Energy production, economic growth and CO2 emission: evidence from Pakistan. *Nat Hazards* 90, 27–50.

Ghouse, G., Hashmat, A., & Athar, A. (2021). Causal Economic Interactions between CO2 Emissions and Economic Growth. *Pakistan Journal of Economic Studies (PJES)*, *4*(1), 45-61.

Haris. M & Tariq.G & Sun.H et.al (2018). trade liberalization, FDI inflows Economic growth and environmental sustainability in Pakistan and India, *Journal of agriculture and environment for international development*, 12(2), 253-269.

Hassan, S.T., Xia, E., Huang, J. (2019). Natural resources, globalization, and economic growth: evidence from Pakistan. *Environ Sci Pollut Res*, 26, 15527–15534.

Ishaq, M., Ghouse, G., Fernández-González, R., Puime-Guillén, F., Tandir, N., & Santos de Oliveira, H. M. (2022). From Fossil Energy to Renewable Energy: Why is Circular Economy Needed in the Energy Transition? Front. *Environ. Sci*, *10*, 941791.

Khan, M.K., Khan, M.I. & Rehan, M. (2020). The relationship between energy consumption, economic growth and carbon dioxide emissions in Pakistan. *Financ Innov*, 6, 1.

Khan, M.K., Khan, M.I. & Rehan, M. (2020). The relationship between energy consumption, economic growth and carbon dioxide emissions in Pakistan. *Financ Innov* 6, 1

Kleemann, L. and Abdulai, A. (2013). The Impact of Trade and Economic Growth on The Environment: Revisiting the Cross-Country Evidence. *J. Int. Dev.*, 25, 180-205.

Kleemann.L & Abdulai.A (2011). The impact of trade and economic growth on the environment: revisiting the cross-country evidence. *Journal of International Development*, 25 (2), P. 180-205.

Mahmood, N., Wang, Z. & Hassan, S.T. (2019). Renewable energy, economic growth, human capital, and CO2 emission: an empirical analysis. *Environ Sci Pollut Res* 26, 20619–20630.

Muhammad. R & Muhammad. I (2020). The relationship between energy consumption, economic growth and carbon dioxide emissions in Pakistan, *financial innovation*, 6 (1), 1-13.

Sajid, A. & Ali, A. (2018). Inclusive Growth and Macroeconomic Situations in South Asia: An Empirical Analysis. *Bulletin of Business and Economics (BBE)*, 7(3), 97-109.

Şentürk, İ., & Ali, A. (2021). Socioeconomic Determinants of Gender Specific Life Expectancy in Turkey: A Time Series Analysis. *Sosyoekonomi*, 29(49), 85-111.

Syed. T and Enjun. X (2019). Natural resources, globalization, and economic growth: evidence from Pakistan, *environmental science and pollution research*, 26, 1-8.

Tariq, G., Sun, H., Haris, M., Kong, Y., & Nadeem, A. (2018). Trade liberalization, FDI inflows economic growth and environmental sustainability in Pakistan and India. *Journal of Agriculture and Environment for International Development (JAEID)*, *112*(2), 253-269.

Wang, Z., Asghar, M.M., Zaidi, S.A.H. (2019). Dynamic linkages among CO2 emissions, health expenditures, and economic growth: empirical evidence from Pakistan. *Environ Sci Pollut Res* 26, 15285–15299.

Wang.Z & Mansoor. M & Anees. S (2019). dynamic linkages among CO2 emissions, health expenditures, and economic growth: empirical evidence from Pakistan, *environmental science and pollution research*, 26, 1-15.