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Urban Population Growth, Per Capita Energy Use, and CO2 Emissions: Evidence from the World's fifth-most Populous Country

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ABSTRACT

Pakistan is the world's 5th most populated country. This growing population is causing numerous social and environmental problems. By the increase in population, energy demand is increasing day by day. Pakistan, where majority of the population is living in rural areas is using uncleaned cooking fuel due to which CO2 emission is increasing that is further a cause of environmental degradation. Based on the data (for the period from 1980 to 2019) of World Development Indicators, this study intends to examine the association between urban population, and energy use with CO2 emission. Unit root test was applied to check stationarity of data and after checking the stationarity status of variables, ARDL (Auto regressive distributive lag model) techniques was applied on data. The outcomes of the study showed that trade openness, urbanization, and energy consumption have significant and positive effects on environmental degradation. This study suggest that government must plan population and take steps towards the use of clean cooking fuels to control environmental degradation.

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1. Introduction

World's 5th and South Asian 2nd most populated country Pakistan has 2.4% population growth rate with the population of 207 million people (WDI, 2018). One of the main reasons of high population growth rate is the less use of contraceptives. Only 34% Pakistani women are using contraceptives. In urban areas of Pakistan, 43% while in rural areas 29% women are using contraceptives. Contraceptive prevalence rate (CPR) in Pakistan is 34%, that is an alarming situation.

Due to low usage of contraceptives in last one-and-half years, 3.1 million unplanned pregnancies were there in Pakistan. To get control on future population burst, it is crucial to increase contraceptive uses. The population growth rate in the urban areas of Pakistan (2.67) is more the urban areas of Pakistan (1.57). The fast population growth is demanding more resources (Urooj, Ahmad, Bhatti, & Hussain, 2022).

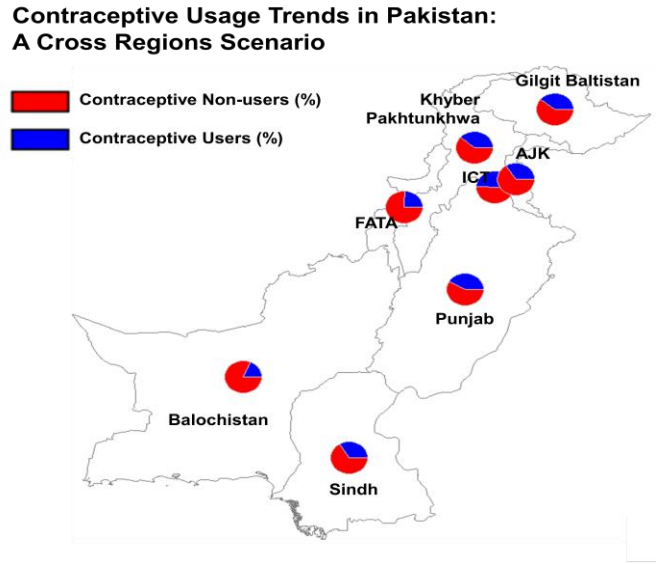

Figure 1: A cross regional mapping of Pakistan w.r.t. the Contraceptive usage (%)

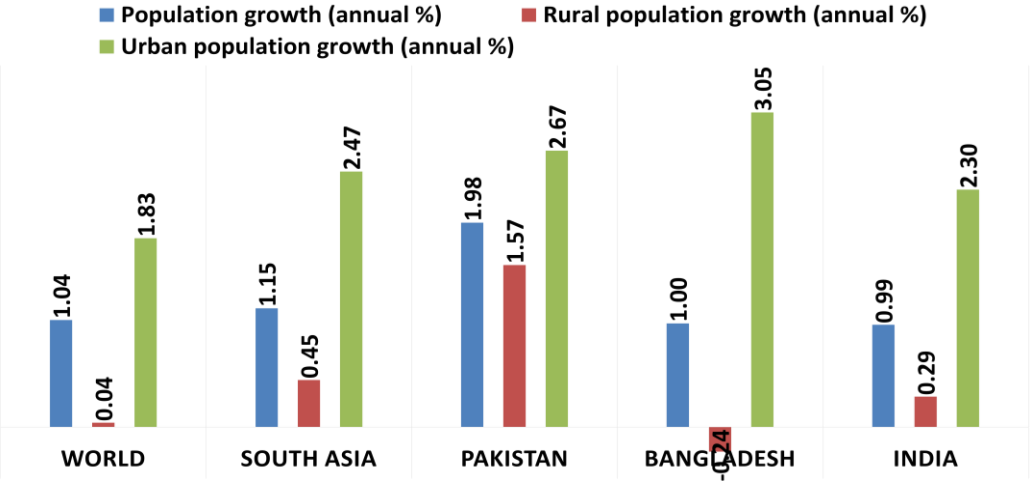

Figure 2: Population Growth Rate of Pakistan in comparison with Globe, Region

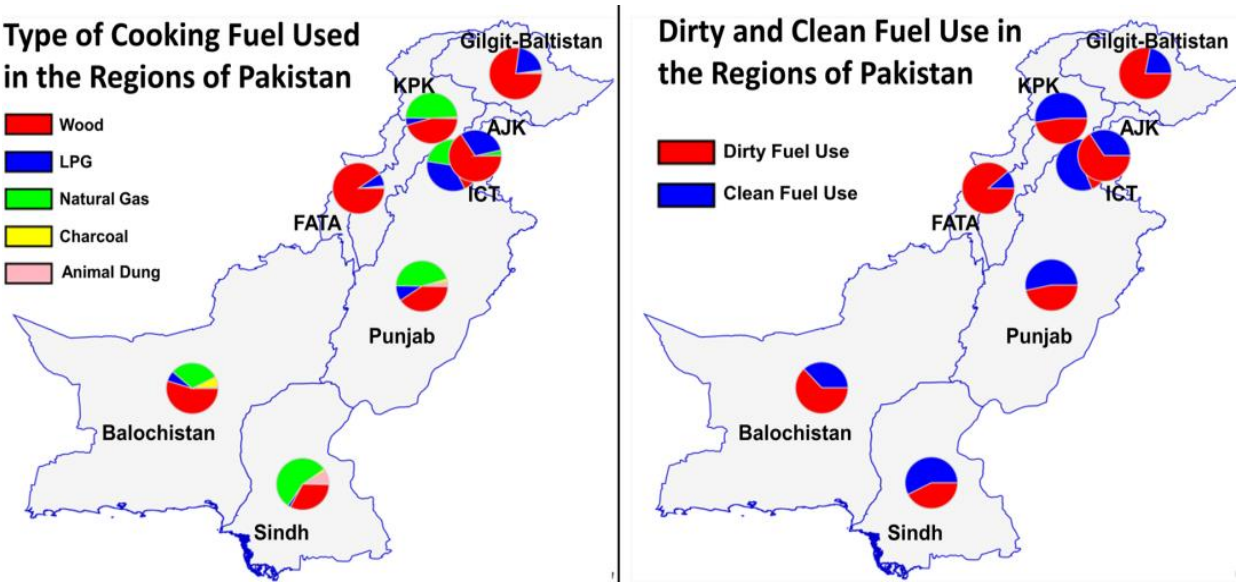

Figure 3: A cross regional scenario of Pakistan w.r.t. the type of cooking fuels (%)

Due to increase in population, energy consumption is increasing. Study organized in 2022 by Ahmad et al. (2022) exhibited that in Pakistan most of the population is using

uncleaned or dirty cooking fuel. The most common fuel used in the Pakistan is LPG, followed by natural gas and then wood. In Pakistan, households utilize charcoal and animal dung as 4th and 5th most popular sources of cooking fuel, respectively. Balochistan, a province of Pakistan with the highest proportion of households using wood and charcoal as a source of cooking fuel. Similarly, Punjab province uses liquefied petroleum gas, crop remainders, and animal manure the most, whereas Sindh uses natural gas the utmost frequently. Large households and households with agricultural land and livestock were more likely to utilize unclean fuel sources for cooking. Urban households and those with higher wealth levels were more likely to cook with clean fuel sources.

Increasing population is playing role as a booster for the emission of CO2 that is causing pollution which leads to the environmental degradation (Ozturk, Aslan, & Kalyoncu, 2010). A study conducted in Pakistan by Mansoor and Sultana (2018) proved that population growth negatively affects the quality of environment. As population increases, energy consumption increases which causes degradation of the environment. The study suggests that to control population by increasing expenditures for family planning services and programs. Ray and Ray (2011) argued that the fast increase in population is a cause of the increase in deforestation, urbanization and industrialization. This is causing some other issues like soil erosion, more demand of resources, and more energy consumption. Due to the pressure on resources, poverty is also increasing that is leading to the environment depletion. This study can be helpful to meet SDGS, population control, to save environment and to make Pakistan clean and green.

2. Literature Review

H. Liu et al. (2023) conducted research in China to check the link among energy consumption, urbanization and CO2 emission by using data from1995-2020. ARDL approach was employed by them. Results cleared that urbanization has no influence on CO2 emanation. Study depicted that use of energy is badly affecting the environment. Xu, Zhang, Huo, Streets, and Wang (2023) conducted a study in China. In this study, effects of urbanization on industrial NOx emissions in a Chinese prefecture-city from 2017 to 2019 are assessed. The findings of this work showed that as urbanization increases, emission of harmful gases increases that leads to the degradation of environment.

Wei, Bi, Liu, Zhang, and He (2023) Using a variety of remote sensing data from 2000 to 2018, study estimated the influence of FDI and multi-dimensional urbanization on carbon emissions. The findings demonstrate how flexible the "Environmental Kuznets Curve" theory is. Local carbon emissions were directly influenced by multifaceted urbanization and FDI, but the effects eventually diminished over time. After adjusting for the direct effects, they discovered that population and land urbanization had consistently increased carbon emissions in nearby areas, while FDI boosted the gain effect on carbon reduction in nearby areas.

Raihan et al. (2023) organized a study to look at the dynamic effects of Thailand's growing economy on CO2 emissions. Data was analyzed using OLS approach. According to projections, economic growth, urbanization, industrialization, and tourism increases CO2 emissions. Further reductions in CO2 emissions by increase in agricultural productivity, forest area and usage of renewable energy. Lee, Zhou, Yang, Yu, and Zhao (2023) conducted study which evaluates that how FDI influences causation amid urbanization and CO2 emissions in China. Findings imply that when urbanization picks up speed, CO2 emissions grow as well, but this negative impact lessens as foreign capital levels rise. We also discover that urbanization can be encouraged to minimize CO2 emissions the more advanced the financial, government, and technology sectors are. These findings have ramifications for China's environmental and urban planning policies.

The study conducted by Cheng and Hu (2023) demonstrated that urbanization have raised CO2 emissions. According to additional evaluations of mechanisms, urbanization raise CO2 emissions. Urban sprawl can raise CO2 emissions from industry, construction,

and transportation, which can raise overall carbon emissions. The "Threshold-STIRPAT" model and the combined intermediate effect model were to examine the effect of urbanization on carbon emissions at various urbanization thresholds. According to the initial findings, as soon as urbanization development rate is lower than 47.04%. As urbanization increases, carbon emission increases (Tan, Yang, & Niu, 2022).

The economic effects of urbanization, including changes in GDP per capita, economic output, income level, and the income disparity between urban and rural areas, were critically examined in this article. Environmental impacts of economic development and urbanization, such as those on temperature, CO2 emissions, water pollution, and health hazards associated with the environment, were also examined. The discussion concluded with policies and recommendations for promoting the sustainable development of urbanization, including limiting population growth and the intensity of urban development, modifying energy and industrial structures, promoting technological innovation and education, and taking future resource capacity into account (L. Zhao, 2023). Y. Zhao et al. (2022) indicated that urbanization has 2 opposing impacts on CO2 emissions: positive correlations between carbon emissions, population, urbanization, and energy intensity, and negative correlations between economic urbanization and social urbanization. Urban CO2 emissions, however, are not significantly reduced by spatial urbanization.

Mignamissi and Djeufack (2022) conducted a study looks at association amid urbanization and CO2 emissions intensity for a panel of 48 African countries between 1980 and 2016. We discovered that, even while urbanization is a significantly substantial contributor to pollution in Africa, the impact varies depending on the level of pollution. Because of the disparity in institutional quality, this effect is more prominent in countries with abundant resources. Further research demonstrates that pollution has simultaneous threshold impacts on urbanization and degree of development. Ultimately, there is no doubt that urbanization has a beneficial and considerable overall impact on global warming.

A study examines the effects of urbanization and usage of renewable energy on CO2 emissions in Europe from 1995 to 2018. The results of this study, which used a spatial temporal method, show that urbanization and CO2 emissions levels climbed towards the North and decreased towards the East, respectively. Urbanization and percentage of renewable energy use both rose in value over time, while CO2 emissions decreased at a rate that was faster than linear. The investigation showed that while an increase in urbanization levels degrades air quality, rise in fraction of renewable energy consumption reduces CO2 emissions (Gillani & Sultana, 2020; Grodzicki & Jankiewicz, 2022).

Haldar and Sharma (2022) investigated the effects of urbanization on energy use and emissions in India in this study. For the analysis, time series data from 1960 to 2015 were taken into account. Affluence has a positive correlation with energy demand (economic growth). Findings also imply that, as urbanization continues, GDP and population will rise in the next years, which will inevitably result in higher carbon dioxide emissions due to an increase in energy demand and consumption. Thus, lowering energy intensity is essential for India's energy security and lowering CO2 emissions.

Generalized Method of Moments is employed in a two-step technique to evaluate secondary World Bank data encompassing 163 nations from 2000 to 2016. Study investigates connection between urbanization, renewable energy, and CO2 emissions. According to this study, urbanization increases CO2 emissions while consumption of renewable energy reduces it (Gierałtowska, Asyngier, Nakonieczny, & Salahodjaev, 2022). Sikder et al. (2022) designed study to know influence of urbanization, and use of energy on carbon dioxide emission. Study employed the data of 23 developing countries. Results show that energy consumption, and urbanization have the greatest impact on CO2 emissions in emerging nations. Bidirectional causative association between energy use, urbanization, and CO2 emissions was also discovered by the panel causality study.

Hussain, Li, and Sattar (2022) examines how usage of nonrenewable energy and urbanization affect carbon emissions. 54 countries of African Union from 1996 to 2019 make up the analysis's context. Their regression findings supported the notion that environmental pollution rises in African Union nations because of using nonrenewable energy. Environmental pollution rises as economic growth rises; but, after a certain point, environmental pollution falls as economic growth rises. The association amongst economic growth and CO2 emissions can be described with inverted U shape. The results also demonstrate the need for planned urbanization, as unplanned urbanization might eventually result in environmental damage. The African continent adopts stringent measures and develops a model for efficient and effective energy consumption and production.

A study was conducted by Khan and Yahong (2021) to check impacts of income inequality, poverty, and population growth on carbon emission. For this purpose, ARDL with Nonlinear ARDL was applied to check long and short run impacts. The results of study showed that as poverty and population increase carbon emission also increases in short and the long run that is causing environmental degradation. J. Liu, Li, and Ding (2021) conducted a study in China to evaluate influence of increasing urban population on CO2 emission. This study depicted that with the increase of urban population carbon emission is increasing in China. Research was designed in Pakistan to discover impact of urbanization on the emissions of CO2. ARDL bound test was used for long and short run estimates and VECM model was employed to check the causality. Outcomes showed that cointegration is among variables. Both in long and short run, urbanization was increasing CO2 emissions. In case of short run, urbanization causes carbon emissions (Ali, Bakhsh, & Yasin, 2019). Chen, Jin, and Lu (2019) organized a study in China to inspect the association among urbanization and energy consumption. The study revealed that the high tend towards the usage of coal, CO2 emission is rising.

Ali et al. (2019) designed a study to discover effect of urbanization on CO2 emission for the time span of 1972 to 2014. ARDL and VECM were employed on the data set. Outcomes showed that urbanization is increasing CO2 emission either it is short run or long run. Results further showed unidirectional causality from urbanization towards CO2 emission. Sharif, Raza, Ozturk, and Afshan (2019) organized a study to evaluate influence of energy consumption on degradation of environment in Pakistan. Data collect from world developer indicator (WDI). The ARDL and Johansson cointegration results depicted that consumption of energy has bad effects on environment.

Sharif et al. (2019) organized a study in Pakistan on environmental degradation in 2018. This was a time series analysis for which the data was collected from WDI from period 1972 to 2014. The dependent variable was environmental degradation. Trade openness, economic growth, gross domestic production CO2 emission, globalization, industrialization, FDI, Principal Index, carbon and energy consumption were used as independent variables in this study. Economic growth has positive influence on energy consumption and increasing energy consuming but has negative impact on environmental degradation.

Mansoor and Sultana (2018) conducted a study to check consequence of population, use of energy on carbon emission. Outcomes showed that energy demand and population growth increase emission of carbon. Shahbaz, Nasir, and Roubaud (2018) analyzed influence of energy consumption on degradation of environment in Pakistan through a time series study. The independent variable are energy consumption foreign trade and per capita income. Johansson cointegration was used to analyze energy consumption on environmental degradation. Income, energy consumption and foreign trade are positive and significantly affecting the environmental degradation while population does not affect it significantly.

Mansoor and Sultana (2018) organized a study in Pakistan to observe the association amid population, CO2 emission, and energy use during period of 1975-2016. ARDL bounds test was used to estimate elasticities. The study confirmed that energy

demand and population growth increase the emission of CO2, whereas association amongst CO2 emissions and GDP is negative in long run. Population growth influenced the quality of environment. Wang, Kang, Wang, and Xu (2017) conducted a study to check the impact of high population growth on emission of CO2. Results indicated that population size has positive link with CO2 emission.

He, Xu, Shen, Long, and Chen (2017) inspected the impact of urbanization on the emission of CO2 in China. This was a panel study. The outcomes of this panel study showed the inverted U shaped relation among CO2 emission and urbanization. A study that was conducted in Malaysia by Bekhet and Othman (2017) discovered relation among urbanization growth and CO2 emission. Results revealed that unidirectional causality prevails in short run from urbanization to CO2 emission while in case of long run, a bidirectional causality prevails among urbanization and CO2 emission.

Sinha, Shahbaz, and Balsalobre (2017) analyzed influence of energy consumption on environmental degradation in N-11 countries. Data, time span was from 1990 to 2014. Outcome variable used in this study was environmental degradation and independent variables were consumption of biomass, trade openness, and economic growth. Results depicted that the trade openness, biomass consumption have negative but significant impact on the environmental degradation. Nasreen, Anwar, and Ozturk (2017) analyzed influence of energy consumption on environmental degradation. Data collected from world develop indicator (WDI). The environmental degradation was considered as an outcome variable. The CO2 emission and economic growth were taken as the independent variables. Results revealed that CO2 has negative effect, and the economic growth was positively influencing environmental degradation.

Shahzad, Kumar, Zakaria, and Hurr (2017) conducted a study to check the impact of energy consumption on environmental degradation in Pakistan. Environmental degradation used as an outcome variable. Carbon emission was used as independent variables. According to them, carbon emission has negative effect on environmental degradation. Zaman, Shahbaz, Loganathan, and Raza (2016) analyzed the influence of energy consumption on degradation of environment in developed and developing countries by conducting a panel study for the time span ranging from 2005 to 2013 for which data was collected from World Development Indicator. The fixed effect Hausman test, EKC hypothesis and Kuznet curve techniques were used for analysis. The economic growth and health expenditure and energy demand are positively affecting the environmental degradation while domestic investment is negative impacting the environmental degradation.

A study that was conducted in 2015 in OECD countries depicts that how increasing demand and the consumption of energy is degrading the environment. The environmental degradation used as dependent variables. Trade openness, economic growth, gross domestic production, CO2 emission, carbon and energy consumption were used as independent variables in this study. EKC hypothesis was used to analyze the potential effect of renewable energy consumption on environmental quality. ADF test was used to investigate significant influence of the energy consumption and economic growth on degradation of environment (Bilgili, Koçak, & Bulut, 2016; Fazal, Gillani, Amjad, & Haider, 2020).

The FMOLS was used to check the impacts of said independent variables on environmental degradation. Energy consumption, urban population, development of industrial and trade openness have positive while political stability has negative influence on environmental degradation (Al-Mulali, Weng-Wai, Sheau-Ting, & Mohammed, 2015). Sadorsky (2014) conducted a study to evaluate the connection between urbanization and emission of CO2 in developing countries. His study depicted a positive connection between urbanization and CO2 emission.

Saboori and Sulaiman (2013) conducted a research study in Malaysia. The outcomes of this study discovered that the energy consumption and economic growth are positive

influencing the degradation of environment. Shahbaz, Lean, and Shabbir (2012) conducted a time series study in Pakistan. ARDL technique was used to analyze the formulated model of this study after checking the status of stationarity through ADF. Findings exhibited that the energy consumption and also the economic growth have positive and significant influence on the degradation of environment.

Ahmed and Long (2012) analyzed, how the consumption of energy is causing environment degradation in Pakistan. The data collected World Development Indicator (WDI). The environmental degradation was used as a dependent variable. VECM and ARDL techniques were used. Study showed that economic growth has negative influence on environmental degradation, energy consumption and trade openness while population has positive influence on the environmental degradation. Shahbaz et al. (2012) conducted a time series study in France. The ARDL, ADF and Kuznet curve techniques were used to for analyses. FDI and energy consumption has positive influence on environmental degradation.

Ray and Ray (2011) showed in their study that was conducted in India that consequences of increasing population growth rates are increasing the density of population and poverty. Population increase is causing land erosion and other environmental issues. The increasing population is a major cause in the increase of energy consumption. Martínez-Zarzoso and Maruotti (2011) conducted a panel study for the developing countries. Aim of this study was to evaluate impact of urbanization on emission of CO2. Outcomes of their study showed the positive association amongst urbanization and CO2 emission.

A study conducted in Pakistan by Alam, Fatima, and Butt (2007) showed the influence of energy's use on environmental degradation in presence of some other control variables. Johansson maximum likelihood approach, Johansson cointegration, VAR, and VECM techniques were used to obtain the outcomes of the study. During short run, economic growth, use of energy, urbanization, and population have positive impact on environmental degradation while their impact in long run is negative on the degradation of the environment. Martínez-Zarzoso, Bengochea-Morancho, and Morales-Lage (2007) explored effect of population on emission of CO2 in European countries. Increase in population growth rate increases CO2 emissions.

Authors (years)	**Economy Under Study**	**Dependent Variable**	**Data type (Time period)**	**Analytical Technique Applied**	**Results**
Al-Mulali et al. (2015)	Middle East and North African	Environmental degradation	1996-2012 Panel data	FMOLS	Energy consumption (+) Urbanization (+) Trade openness (+) Industrial development(+) Political stability(-)
Shahbaz et al. (2018)	France	Environmental degradation	1955-2016 Time series data	ARDL ADF Kuznet curve	FDI (+) Financial development (-) Energy consumption (+) Energy research (-)
Zaman et al. (2016)	Developed and Developing countries	Environmental degradation	Panel data 2005-2013	Fixed effect Hausman test EGLS SLSLS EKC Hypothesis Kuznet curve	Economic growth (+) Domestic investment (-) Health expenditure (+) Energy demand (+)
Nasir and Rehman (2011)	Pakistan	Environmental degradation	1972-2020 Time series data	Johansson cointegration like hood approach ADF	Per capita income (+) Foreign trade (+) Energy consumption (+) population not effect
Saboori and	Malaysia	Environmental	1980-	ARDL Johansen	U-Shaped relationship

Sulaiman (2013)		degradation	2009 time series data	juselius maximum like hood approach ADF	EKC not supply to energy consumption energy consumption (+) economic growth (+)
Shahzad et al. (2017)	Pakistan	Environmental degradation	Time series data 1985-2014	ARDL ADF	F. D (+/-) Economic growth (+/-) Energy consumption (+/-)
Tang and Tan (2015)	Vietnam	Environmental degradation	Time series data 1976-2009	Kuznet curve Granger causality test VECM ADF EKC Hypothesis	Energy consumption (+) Income (+) income (-) FDI (-) Economic growth (+)
Sinha et al. (2017)	N- 11 countries	Environmental degradation	Panel data 1990-2014	GMM Kuznet curve (EKC)	Trade openness (-) Biomass consumption (-) Economic growth (-)
Alam et al. (2007)	Pakistan	Environmental degradation	Time series data 1971-2005	ADF, Johansen maximum like hood approach Johansen cointegration, VAR, VECM	economic growth (+) Energy intensity (+) Urbanization (+) Population (+) in long run Economic growth (+)
Rehman and Rashid (2017)	SAARC Nation	environmental degradation	Panel data 1980-2013	Cointegration	Economic growth (+) energy consumption (-)
Bilgili et al. (2016)	Turkey OECD countries	Co2 emission	Panel data 1977 to 2010	EKC hypothesis	GDP per capita (+) GDP per capita squared (-) Renewable energy consumption (negatively correlated)
Arishan Sharif, Syed Ali Raza 2016	Pakistan	Environmental degradation	Time series data 1972-2013	Panel cointegration and Panel unit root test	Urbanization (+) energy consumption (+)
Seker, Ertugrul, and Cetin (2015)	Turkey	Environmental degradation	Time series data 1974-2016	ARDL Test	Co2(+) FDI (-)
Nasreen et al. (2017)	South Asian economies	Environmental degradation	Time series 1980-2012	OLS technique	Co2 emission (+) Economic growth (+)
Shahzad et al. (2017)	Pakistan	Environmental degradation	Time series data 1971 2011	ARDL technique	Carbon emission (+)

3. Data and Econometric Approaches

3.1 Data

This study is based on secondary data range 1980-2019 and obtained from the "World Development Indicator" including (environmental degradation was measured as CO_2 emission dependent variable and independent variables are energy price trade openness industrial growth urbanization foreign direct investment. According to our knowledge as no study was done on energy consumption impact on environmental degradation in Pakistan.

3.2 Selection of Variables

The possible and effective variables were selected for this study from WDI that are listed below in table 2.

Table 2

Aberration	Variables	Measure	Data Source	Expected Sign
ENV	CO_2 emission	CO2 emissions from consumption of solid fuel (% of total)	WDI	
ENERPC	Energy use Per capita	Use of energy (kg of oil equivalent per capita)	WDI	-ve
TRADE	Trade openness	% Annual	WDI	+ve
INDUS-GROWTH	Industrial growth	Industry, value added (annual % growth)	WDI	-ve
URB	Urbanization	Urban pop. Growth (annual %)	WDI	-ve
FDI	Foreign direct investment	% Of GDP	WDI	+ve

$$CO2 = \beta_0 ENERPC + \beta_1 TRADE + \beta_2 INDUS - GROWTH + \beta_3 URB + \beta_4 FDI + \gamma_i \quad (1)$$

4. Results and Discussion

4.1 Unit Root Test

Firstly, ADF was applied to check stationarity of variables used in model. Results of this test is given in table below.

Table 3
Results of ADF

Variable	Level-Level Test Statistics (Prob. Value)	First Difference Test statistics (Prob. Value)	Decision
Urban Population	0.8969 (0.7806)	-4.1224*** (0.0022)	I(1)
ENER PC	-.2963 (0.1773)	-5.3570*** (0.0000)	I(1)
Fossil Fuel	-2.4859 (0.1251)	-6.4965*** (0.0000)	I(1)
CO2	0.7526 (0.9921)	-7.1776*** (0.0000)	I(1)
Trade Openness	-4.9052*** (0.0002)	-8.0974*** (0.0000)	I(0)
FDI	-3.1009** (0.0333)	-4.7568*** (0.0003)	I(0)
INDUS VA	-4.9052 (0.1860)	-7.7310*** (0.0000)	I(1)
Industrial Growth	-5.7423*** (0.0000)	-9.2236*** (0.0000)	I(0)

*, **, *** variable stationary at 10%, 5%, 1% respectively.

On the basis of these results ARDL technique was applied on the model.

4.2 Long Run Coefficient

It is clear from the above table that energy per capita has positive and significant association with the dependent variable CO_2. This means that one unit increase in energy per capita will lead CO_2 to increase by 0.83 units. Thus, the study concluded that the flow of energy per capita over the years into the Pakistan economy had retarded environmental growth rather than enhancing it.

Table 4
Estimates of Long Run

Variables	Coefficient	SE	T. statistics	P. Value
Urban Population	0.073	0.002	26.033	0.0000
Energy per capita	0.839	0.135	6.186	0.0000
Trade openness	0.002	0.001	2.268	0.0318
Industrial growth	0.001	0.000	1.364	0.1841
FDI	0.002	0.004	0.699	0.4905
C	0.363	0.292	1.242	0.2252

Trade openness is positively and significantly affecting the CO2 emission. If trade openness increases by one unit, then CO2 emission will increase 0.002 unit. Industrial growth is positively affecting the emission of CO2. If industrial growth increases by 1% than the CO2 emission will increases by 0.001%. 1% increase in urbanization is causing 0.073% increase in CO2 emission. If foreign direct investment increases by 1% then the emission of CO2 will increase by 0.002%, the relation among these two variables is positive and insignificant.

4.3 ARDL Bound Test

ARDL Bound Testing Approach is a co-integration technique that is used to test the existence of long run connection amongst variable.

Table 5
ARDL Bound Test

Test Statistic	Value	K
F-Statistic	6.132931	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

In the above table it is cleared that F-statistic value is 6.132 which is higher than upper bound value 3.36 at level of significant 10% other upper value 3.79 at 5% level of significance, another upper value 4.18 at 2.5% level of significance and at then 1% level of significance upper value bound value is 4.68 when CO_2 is dependent variable and all others all independent variables. As a result, it can be concluded that there is long run cointegration association amongst study variables.

5. Conclusion and Policy Recommendations

Study empirically inspected influence of energy consumption on environmental degradation and other selected variable (economic growth, foreign direct investment energy consumption and industrial growth in Pakistan by using ARDL bound test. Main goals were to detect energy consumption on environmental degradation in Pakistan and on basis of finding, recommendations were proposed to improve the environment. According to the best of our knowledge as no study was done on energy consumption impact on environmental degradation in Pakistan. For this purpose, data had taken from the period 1980 to 2019. Energy consumption has been measured by taking number of energy per capita while environmental degradation is measured by CO2 emission. Data for these indicators was taken from WDI. Results showed that energy consumption, economic growth, FDI and trade has positive and statistically significant influence on environmental degradation it indicates environmental degradation increase because of increase in energy consumption. On basis of these results, study suggests that government must plan population through contraceptives. To meet SDGS, to control environment degradation and

to make Pakistan clean and green it is crucial for government to take steps towards clean cooking fuel.

Authors Contribution
Tusawar Iftikhar Ahmad: study design, critical revision, incorporation of intellectual content
Muhammad Azhar Bhatti: data analysis, data interpretation
Komal Urooj: literature search, data collection, drafting
Hira Javed: introduction, data collection, drafting

Conflict of Interests/Disclosures
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