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Article

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Evidence-based Examination of the Consequences of Financial Development on Environmental Degradation in the Indian Setting, Using the ARDL Model

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ABSTRACT

The purpose of this study is to investigate India's long-run equilibrium relationship between carbon emissions, financial development, energy consumption, urbanization and trade openness from 1960 to 2020. The analysis of the sources of carbon emissions by taking into account the role that financial growth and trade openness plays and using data from a single country is the most significant contribution that we have made to the existing body of research on Indian studies, using an updated dataset and methodology. According to the findings, there is evidence of long-term relationship between trade openness, financial development, urbanization, energy consumption and carbon emissions. Given that each of the variables has a positive association with the carbon emissions; this indicates that each of the variables contributes to environmental degradation, since they emit a significant amount of carbon dioxide into the atmosphere, in the context of India over the time period of the study that was observed. According to the data presented, the functioning of the financial system ought to incorporate an awareness of its impact on the surrounding environment. The findings of this study could be of tremendous significance for those responsible for formulating policies and making decisions in the area of energy in India, particularly those that contribute to the reduction of carbon emissions while maintaining environmental integrity.

Keywords: Carbon Emissions, Financial development, Energy Consumption, Urbanization
JEL Classifications: C32, Q43, Q53

1. INTRODUCTION

Degradation of the environment has developed into a serious issue that affects every nation, despite the fact that certain nations are more to blame than others for the accumulation of greenhouse gases. The degradation of the environment is a problem that affects all parts of the world, and the consequences of this problem are felt everywhere. One of the causes of a decline in the overall quality of the environment is the release of carbon dioxide (CO_2). Primary contributors to the greenhouse effect and a topic that has received a lot of attention in recent years. The burning of fossil fuels including coal, oil, and natural gas is the primary source of CO_2 emissions. Gas emissions of CO_2 in a country are influenced by a number of factors including: income level, energy use, and population, consumption, population, international trade, etc. The most significant and debatable problems facing the environment in our day are undoubtedly climate change and global warming. There is a large amount of agreement among experts that accumulated CO_2 emitted by the burning of fossil fuels, in addition to the contributions made by other human-induced sources of greenhouse gas (GHG) emissions, the combustion of fossil fuels is contributing to the warming of the climate oceans of the planet (Intergovernmental Panel on Climate Change, 2007). Global environmental concern and a major objective of the sustainable development agenda is environmental contamination in the form of CO_2 emissions. The increase in energy demand in emerging economies is a result of overall domestic spending, which in turn contributes to CO_2 emissions (Ahmad et al., 2018).

India, which has the world's second highest population and more than 1.1 billion people, is one of the countries that emit the least amount of GHGs per person than any other country on the planet. In 2008, the country had an emission rate of 1.18 tons of carbon equivalent per capita, which was approximately one-fourth of the global average of 4.38 tons for that measure. However, because a huge portion of the population in India relies on agriculture and forests for their livelihood, the country is extremely susceptible to the effects of climate change. The Indian economy is also reliant on natural resources, making it vulnerable to the effects of any negative influence on these and other industries will be counterproductive to the government's efforts to end poverty and provide a sustainable means of subsistence for the populace.

India places a high value on furthering its own development. The economy expanded at an annual rate of 7.7% on average between the years of 2000 and 2007, while carbon emissions from fossil fuels climbed by 125% between the years of 1950 and 2008. As a result, the country is now the third greatest fossil fuel CO_2 emitter in the world. The government of India has provisionally set a target for the growth of the country's gross domestic product (GDP) of 9%, as described in India's 12th Five Year Plan (2012-2017), which will require the country's energy supply to rise at a rate of 6.5% each year. India made the goal of achieving its growth trajectory in an environmentally sustainable manner known in December 2009 when it announced that it would aim to reduce the emissions intensity of its GDP by 20-25% from 2005 levels by the year 2020. India is aware of the importance of achieving its growth trajectory in an environmentally responsible manner. As a result, India is in the position of having to face the problem of locating the common ground between climate change policy and economic growth and then adopting policies that fulfill both of these goals. Since 1991, when the government first implemented liberalization and globalization policies, the Indian economy has seen a huge amount of change. As part of the government's economic reform program, reforms to the banking sector have also been implemented since that time. As a direct result of this, interest rates were gradually allowed to become more flexible, and reserve and liquidity ratios were dramatically lowered. In 1969, there were just 8,262 bank branches across the country, but by 2011, that number had climbed to 62,607. During this time period, the percentage of deposits that are considered to be domestic credit to the private sector by banks has climbed from 10.22% to 49.73% of the GDP (Economic Survey of India, 2011-2012).

Nevertheless, the rapid expansion of economic activity and development of the financial sector has been accompanied by the deterioration of the natural environment. Additionally, between the years 1991 and 2010, there was a 172% increase in the amount of carbon emissions. In point of fact, India may greatly benefit from this study in terms of formulating a strategy to reduce the intensity of its carbon emissions. Energy consumption (measured in kg of oil equivalent per person) skyrocketed between the years 1991 and 2011, going from 371 to 613. Because there are only a small number of empirical evidences on the linkages between financial sector development and environmental performance, the purpose of this paper is to investigate the relationship between financial development and environmental degradation in the Indian economy in order to make a contribution to the existing body of research. This study takes the previously described multivariate framework one step further by incorporating the effects of various stages of financial development into the center of it all. According to our knowledge, there has never been an effort made to explore the factors that contribute to India's carbon emissions by taking into mind the function of expanding financial markets, trade openness, urbanization, investment and energy use and making use of single country statistics. This study is an attempt to close that knowledge gap. Regarding this point in this paper, we show that the problem of omitted variable bias in econometric estimation can be mitigated by studying the relationship between carbon emissions and financial development. This attempt might also succeed in being of utmost significance for policymakers and decision-makers to improve their understanding of the factors that determine carbon emissions in order to come up with implementation of sound energy policies that will mitigate the negative effects of human activities and, as a result, contribute to the reduction of carbon emissions while keeping the rate of economic expansion stable.

2. LITERATURE REVIEW

Environmental deterioration is caused by many macroeconomic factors. Economic development and energy consumption are significant drivers, according to earlier studies. For the deterioration of the ecology in numerous nations. The quick utilizing natural resources for industrial purposes could increase economic growth, particularly in emerging nations like India. There is a lot of research on the relationship between economic environmental degradation closely related to economic variables (Jalil and Feridun 2011; Aye et al., 2017; Khan et al., 2020a; Khan et al., 2019c; Shahbaz et al., 2016a, b, 2019).

2.1. Financial Development and CO_2 Emissions

The policymakers might benefit from encouragement on the connection between ecological and economic elements. Financial development is crucial for economic expansion that causes environmental deterioration in emerging economies. Together, financial development and CO_2 emissions are a significant problem now. In recent literature, the effect of financial development on environmental conditions has received more and more attention. Future CO_2 emissions reduction may be made achievable by enhancing institutional quality (Wawrzyniak and Doryń, 2020). Financial development and CO_2 emissions have been linked in an increasing body of research (Zhang 2011; Shahbaz et al., 2013; Ozturk and Acaravci, 2013; Ziaei, 2015; Abbasi and Riaz, 2016; Xing et al., 2017; Xu et al., 2018; Jiang and Ma, 2019).

Yuxiang and Chen (2011) examined the relationship between financial development and industrial pollutants using province economic data from China and discovered environmental gains as a result of financial development. They argued that raising income and capitalization, utilising new technology, and enacting environmental legislation are all ways that financial development enhances the quality of the environment. In the instance of

China from 1953 to 2006, Jalil and Feridun (2011) looked into the effects of financial development, economic expansion, and energy consumption on CO_2 emissions. The analysis's findings showed that the coefficient of financial development had a negative sign, indicating that China's financial success had not come at the expense of environmental degradation. Contrarily, it is discovered that financial development prevents the deterioration of the environment. The causal relationship between financial development, openness, economic growth, energy consumption, and carbon emissions in Turkey from 1960 to 2007 was explored by Ozturk and Acaravci (2013). According to empirical findings, there is a long-term correlation between carbon emissions, energy use, income, openness ratio, and financial progress. The outcomes also validated the EKC hypothesis' applicability to the Turkish economy. On the other hand, long-term carbon emissions are not much impacted by financial development. Shahbaz et al. (2013) used the Autoregressive Distributed Lag (ARDL) bounds testing approach to co-integration to analyze the effects of financial development, economic growth, coal consumption, and trade openness on environmental performance in South Africa between 1965 and 2008. The empirical results showed the long-term relationships between the variables and furthermore, they supported the validity of environmental Kuznets. Results indicated that while financial development lowers energy emissions, economic growth raises them. The South African economy's environment has been negatively impacted by the consumption of coal. In his research on the causes of economic growth, trade openness, financial development, energy consumption, and carbon emissions in India, Boutabba (2014) discovered that financial development had a long-term positive effect on carbon emissions. Studies conducted in a similar vein by Sehrawat and Mohapatra (2015) for India and Komal and Abbas (2015) for Pakistan confirmed the same thing as well. In the Long-term, the development of financial markets is harmful to the environment. Khan et al. (2018) evaluated the effects of financial development, energy usage, and economic inequality on CO_2 emissions in three emerging economies: Bangladesh, Pakistan, and India. Specifically, they focused on India because it is the most populous of the three countries. They made the observation that Pakistan and Bangladesh's financial development has a negative influence on CO_2 emissions, while India's financial development has a positive impact on emissions, and that energy consumption is the primary contributor to CO_2 emissions in these nations. Economic growth, energy consumption, and financial development all have long-term beneficial effects on CO_2 in China, according to Ahmad et al. (2018)'s analysis and research. Additionally, he came to the conclusion that, over the long term, CO_2 emissions are more affected by the beneficial aspects of financial development than the bad ones. Empirical research conducted by Lahiani (2020) came to the conclusion that financial development causes an unbalanced long-run influence on CO_2 emissions and has the potential to contribute to China's CO_2 emission reduction efforts.

2.2. Trade Openness and Carbon Emissions

The degree to which an economy is open to trade with other economies around the world is denoted by the term "trade openness." It allows countries to grow exports that seek to expand domestic production, which leads to increased pollution (Jun et al., 2020). This is done by increasing the scale of industries, which also leads to increased pollution. There does not appear to be any agreement among experts regarding the connection between trade openness and pollution. The degree to which countries are willing to engage in international trade has a direct correlation with the amount of pollution in the environment (Al-Mulali et al., 2016; Jun et al., 2020; Lin, 2017; Wen and Dai, 2020).

However, there is a lack of consensus regarding whether or not an expansion of trade opens leads to a reduction in pollution (Ghazouani et al., 2020; Kohler, 2013; Shahbaz et al., 2017). Although not many people notice any distinctions in the way the relationship is affected by the economic income. For instance, Wang and Zhang (2021) found that the association between pollution and trade openness is favourable for low-income countries, but unfavourable for high-income and middle-income nations. It is anticipated that developing nations with fewer environmental laws will see a rise in emissions as a result of greater trade openness and FDI (Sajeev and Kaur, 2020). In the instance of China, Jayanthakumaran et al. (2012) found a negative association between the two variables, but in the case of India, they found a positive relationship between the two variables. Kwame (2013) conducted study into the link between Ghana's economic expansion and its level of trade openness. He discovered that there is a positive connection between the two factors. According to the findings of Nduka (2013), economic growth in Nigeria was strongly influenced favourably by openness to trade. Keho (2017) discovered, through the use of the ARDL method, that openness has a favourable impact on the GDP of Cote d'Ivoire. According to the findings of Topalova's (2004) research, there is evidence of a positive correlation between economic growth and openness to trade in India. He hypothesised that increased access to foreign markets would have a beneficial effect on the productivity of businesses, which, in turn, would boost India's overall economic performance and standard of living. According to Barua and Chakraborty (2006)'s investigation of the relationship between trade openness and the performance of India's industrial sectors, liberalisation and economic growth are positively correlated. They cited how price margins were affected by openness, reducing overconcentration in the manufacturing sector and increasing consumer surplus. In his studies on India, Dash (2009) found evidence of a long-term association between exports and output as well as a one-way causal chain connecting exports to economic growth. He insisted that freer commerce promotes economic expansion. Marelli and Signorelli (2011) discovered that trade openness had a favourable effect on the economic growth of China and India using the Two-Stage Least Squares approach. According to Jalil and Mahmud (2009), trade had little to no effect on carbon emissions, which are mostly driven by income and energy use. In the regression analysis, the authors do not take investment into account as a potential control variable.

2.3. Other Explanatory Variables

Recent multivariate research conducted in India has produced findings that are somewhat contradictory to one another. Ghosh (2010) discovered, through the use of an ARDL limits testing methodology and a Johansen-Juselius maximum likelihood procedure, that carbon emissions and economic growth have a bidirectional causation in the short run, but none in the long run. It is important to note that although the author controls for the impact that population increase plays, he does not account for the function that trade openness plays. Jayanthakumaran et al. (2012) discovered that structural modifications did not have an effect on the amount of CO_2 emissions. However, per capita income and energy consumption did have an effect. According to the findings of the same study, unlike China, trade openness did not have a major impact on the long-term level of carbon emissions.

Over the course of the past two decades, a new body of research has emerged that examines the relationship between rising rates of economic growth and rising rates of energy consumption on the presumption that higher rates of economic growth necessitate higher levels of energy consumption. In point of fact, a higher level of economic growth can only be accomplished through the utilisation of energy in a manner that is more efficient. Nevertheless, the direction in which causality operates might work in either direction. Following the work of Kraft and Kraft (1978), a large number of empirical research (Narayan and Singh, 2007; Wolde-Rufael, 2006; Yang, 2000) have used panel data to investigate the relationship between economic growth and energy use across nations and have found varied results (Halicioglu, 2009). The research conducted by Liang et al. (2009) investigates the general equilibrium analysis of energy end-use efficiency and CO_2 emissions in China. The researchers mix carbon pricing with subsidised hydropower. After conducting an input-output analysis to determine the relationship between China's structural change and energy use, Kahrl and Roland-Holst (2009) reached the conclusion that China's policymakers will face challenges as a result of the growth in energy demand. In the case of India, Pradhan (2010) discovered unidirectional causation between rising GDP and rising power consumption in both the long and short short-runs, and he recommended formulating an appropriate energy policy in order to encourage long-term, sustainable GDP growth. Vidyarthi (2013) discovered that there is a unidirectional causality running from energy consumption and carbon emissions to economic growth in the long-run. He also discovered that there is a unidirectional causality running from energy consumption to carbon emissions, economic growth to energy consumption, and carbon emissions to economic growth in the short-run. As a result, it was reached the conclusion that any effort to limit CO_2 emissions could potentially lead to a slowdown in India's economic growth. A number of other researchers, such as Masih and Masih (1996), Yang (2000), Narayan et al. (2008), Apergis and Payne (2009), Ozturk (2010), and Lau et al. (2011), tested the relationship between energy consumption and economic growth using a range of methods and for a diverse panel of nations. A thorough literature review of the empirical research of the energy-GDP nexus is provided by Ozturk (2010).

Urbanization has raised concerns about its effects on the environment and its role in fueling the energy crisis, and other researchers have looked at the relationship from numerous angles link energy use, urbanisation, and CO_2 emissions. The literature study and poll confirm the researchers' concerns about urbanisation, energy use, and CO_2 emissions on a national scale. At the national level, there is no universally acknowledged agreement that academics can adhere to. Urbanization had significant statistical effects on energy consumption in Thailand and Indonesia, according to a study by Azam et al. (2015) in a balanced dataset of 99 nations over the course of 30 years, from 1975 to 2005, Poumanyvong and Kaneko (2010) employed the Stochastic Impacts by Regression on Population, Affluence and Technology (STIRPAT) model to examine the effects of urbanisation on energy consumption. Zhang and Lin (2012) reported an increase in energy consumption and CO_2 emissions as a result of China's urbanisation using the same model. Similar outcomes were reached from the Chinese provinces of Beijing and Guangdong. Inmaculada and Antonello observed an inverted U-shaped link between urbanisation and CO_2 emissions in their study on a sample of developing nations. Richard et al. (2003) established an intriguing link. Population was discovered to have a unitary elastic impact on both CO_2 and the energy footprint. The same research team's findings are supported by a subsequent study from 2003, which finds that non-tropical countries exhibit higher emissions than non-tropical countries and that wealth drives emissions. In their study, Ying et al. (2006) found that a country's degree of development affects the population, technology, and wealth effects on CO_2 emissions.

3. METHODOLOGY

We have identified in this study article a number of macroeconomic determinants that are capable of influencing the level of environmental quality in India. As was mentioned in the beginning, the two topics of "financial development" (FD) and "trade openness" (TO) receive the majority of our focus and consideration. The econometric model can be shown by looking at the following equation:

$$CO_2 = f(FD_t, URB_t, TO_t, EU_t) \quad (1)$$

Where
CO_2 represents environmental quality
FD represents financial development
URB represents urban population
TO represents trade openness
EU represents energy use

Data for all these variables was taken from the World Bank Tables and all of the variables are changed into forms that are log-linear (LN). The Table 1 gives the description and the source of the variables:

The log version of the variables will show how elastic the tested variables are in the short run and the long run. It can also cut down on sharpness of the time series data so we can have a consistent picture of the estimations (Shahbaz, 2010). The version of the log that model based on Equation 2, the following can be seen:

$$\mathrm{LCO2_t} = \beta o + \beta_1 LFD_t + \beta_2 LURB_t + \beta_3 LTO_t + \beta_4 LEU_t + u_t \quad (2)$$

In developing countries like India, environmental damage (LCO_2) is likely to get worse as the economy grows. It is likely that financial development (LFD) will have either a positive or negative effect on LCO_2. Jensen (1996) says that the growth of the financial

Table 1: Data description and source

Code	Meaning	Measurement
TO	Trade openness	The total sum of import and export for goods (% of GDP)
CO_2	CO_2 emissions	Per capita CO_2 emissions
FD	Financial development level	Domestic private sector credit (% of GDP)
URB	Urbanization level	Urban population (%)
EU	Energy use	Energy consumption per capital (kg of oil equivalent)

Source (s): World Development Indicators (WDI)

sector could spur technological progress in the energy sector that would help cut down on emissions. On the other hand, the financial sector also contributes to CO_2 emissions by helping to make things. Financial development (LFD) could improve research and development (R&D) and, in turn, make the economy better, which would affect the quality of the environment (Frankel and Romer, 1999). The relationship between India's urban population (LURB) and LCO_2 is also expected to be positive. Higher urbanization meant that a lot of new homes or businesses were being built, which led to more energy use and more pollution in the country.

CO_2 emissions should go up or down depending on how open trade is. Shahbaz and Rahman (2012) say that international trade is good for the environment because it encourages countries to use scarce resources in the best way possible. On the other hand, Copeland and Taylor (2004) and Jalil and Mahmud (2009) discovered a link between increased trade openness and decreased CO_2 emissions. This connection was determined to be beneficial. They believe that increased international trade leads to an increase in CO_2 emissions because it causes a greater consumption of natural resources. Next, in a manner parallel to that of LFD, there is a positive correlation between energy consumption and LNCO2 levels. A rise in the use of fossil fuels to generate electricity will result in an increase in the amount of carbon emissions produced in the country.

3.1. Estimation Procedures

So as to ensure the reliability of the model to test the relationship between the give variables, we employ the following procedures, i.e., unit root tests, the ARDL Bounds test, and the Error Correction Form (ECM).

3.2. Unit Root Test

In order to carry forward further econometric analysis, it is mandatory to test for the stationary qualities of the variables. This is very helpful to avoid the spurious results. The current study employs the Augmented Dickey Fuller (Dickey and Fuller 1979) and Phillip Peron (Phillips and Peron 1988) unit root tests. The ADF unit root test is applied to know the stationary traits of the variables and to cross check the results; we employ the PP unit root test as it is superior to the ADF test. PP is a non- parametric test and moreover it does not need to select the serial correlation levels as is done in the ADF test.

3.3. ARDL Bounds Test

In order to estimate the short run and the long run coefficients, we employ ARDL bounds test which was developed by Pesaran and Shin (1995) and Pesaran et al. (2001). The reason for choosing ARDL for cointegration analysis is that it is suitable for small sample size and it can be applied on the mixed order of integration, i.e., I(0) or I(1). Moreover, it can choose different optimum lag lengths thus it helps in saving the degree of freedom. ARDL provides an unbiased estimate if there is any endogineity in the independent variables (Odhiambo, 2009; Pesaran et al., 2001). For our model, the linear ARDL form of equations is as follows:

$$\begin{aligned}\Delta LCO2_t &= \beta_0 + \beta_1 LCO2_{t-1} + \beta_2 LFD_{t-1} + \beta_3 LURB_{t-1} \\ &+ \beta_4 LTO_{t-1} + \beta_5 LEU_{t-1} + \sum_{i=1}^{p} \alpha_{1i} \Delta LCO2_{t-1} \\ &+ \sum_{i=1}^{q} \alpha_{2i} LFD_{t-1} + \sum_{i=1}^{r} \alpha_{3i} LURB_{t-1} + \sum_{i=1}^{s} \alpha_{4i} LTO_{t-1} \\ &+ \sum_{i=1}^{t} \alpha_{5i} LEU_{t-1} + u_t \end{aligned} \quad (3)$$

Where Δ is the difference operator; β_0 is the intercept term; u_t is the error term; p, q, r, s, t, u and v are the optimal lag lengths; i represent the value of optimal lag; β_1, β_2, β_3, β_4 and β_5, are the long run coefficients.

The above equation is used to test the null hypothesis of no cointegration among the given variables. The existence of null hypothesis that there is no long run relationship, is tested by the following equation: $H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$. The existence of a long run cointegration is determined by the means of F-Statistics. A long run relationship can be claimed only if the estimated value of F-Statistics from the Bounds tests is greater than upper critical value. The null hypothesis of no cointegration is accepted when the F-value falls below the lower critical bound value.

Once the cointegration among the variables is confirmed, the long run coefficients of the ARDL model are estimated by using the below equation:

$$\begin{aligned}LCO2_t &= C1 + \sum_{i=1}^{p} \alpha_{1i} \Delta LCO2_{t-1} + \sum_{i=1}^{q} \alpha_{2i} LFD_{t-1} \\ &+ \sum_{i=1}^{r} \alpha_{3i} LURB_{t-1} + \sum_{i=1}^{s} \alpha_{4i} LTO_{t-1} + \sum_{i=1}^{t} \alpha_{5i} LEU_{t-1} \\ &+ \Omega ECT_{t-1} + u_t \end{aligned} \quad (4)$$

Where ECT_{t-1} is the lagged value of error correction term. This term represents the speed at which a short run disequilibrium is restored after a short-run shock. Ω is the coefficient of the error correction term.

4. RESULTS AND DISCUSSIONS

4.1. Unit Root Tests

The results of the ADF and PP unit root tests are presented in the Table 2. It shows that the variables CO_2 emission, Urbanization and Trade openness are stationary at level and Energy use and Financial development are stationary at the first difference.

4.2. Cointegration Test

From the stationarity results, it is evident that the variables are integrated of mixed order, i.e., they follow the I(0) and I(1) processes, thus ARDL is the suitable technique to use for checking the long-rung cointegration. The optimal lag length has also been selected so as to carry forward the ARDL Bounds test.

The result of the Bounds test is given in Table 3. The dependent variable is the CO_2 emissions and the explanatory variables are Financial development, Urbanization, Trade openness, and Energy use. After estimating the model, the calculated F-Statistics is 11.93, which is higher than the critical value of upper bound I(1) at the 5 per cent significance level. This demonstrates that cointegration does exist among the given variables, which suggests that all of the variables that were utilised in this research have a strong connection with one another.

4.3. Short-run and Long-run Estimates

In this section, the results of both short-run and long-run elasticity are presented. The results of short-run elasticities are currently being emphasized based on its present coefficient value only (without lag). On the basis of the first independent variable, it is discovered that financial development (LFD) has a significant and positive relationship with LNCO2 in the long run. A 1% increase in financial deepening (LFD) leads to an increase in carbon emissions by 0.8% in the long run and the results are in line with Sharma et al. (2019) and Acharya (2003). Financial development suggests improved loan access, increasing consumer demand for products with carbon-intensive technologies like automobiles, bikes, refrigerators, etc. (Zhang 2011). According to Jensen (1996), financial prosperity draws FDI, and as these foreign investments grow, more industrial activity expands, increasing pollution. Furthermore, Zhang (2011) contends that as the financial industry grows, it may provide listed firms in the financial markets easier financing options, which will result in more energy-intensive projects and higher CO_2 emissions. In a similar vein, Jensen (1996) remarked that when the financial sector expands, so do industrial operations, which in turn cause contamination of the environment. The Figure 1 explains the nexus between financial development and CO_2 emissions:

Urban population (LURB) also has a significant and positive relationship with carbon emissions (LCO_2) in the long run. For example, a 1% increase in LURB increases emissions by 1.53%. This finding is in line with literature such as Dhakal (2009). Moreover, Our findings regarding urbanisation are consistent with those of other studies. For instance, urbanisation has been characterised by Liu and Bae (2018) as a contributor to CO_2 emissions in China. Similarly, a study for Pakistan that used the ARDL and VECM models discovered that urbanisation has a favourable impact on CO_2 emission. Ali et al. (2019). Urbanization boosts productivity and innovation, which support long-term economic growth (World Bank, 2019). According to statistics, 50% of the world's population, which is rising every day, now resides in metropolises, which also account for 80% of the global GDP. However, as cities consume two-thirds of global energy and produce 70% of GHG emissions, urbanisation poses issues (World Bank, 2019). Researchers have highlighted an inverted U-shaped correlation between pollution and urbanisation in modern ecological and environmental theories, and as a result, the relationship may become more positive or negative as urbanisation increases. Far East Asian countries have experienced a recent surge in urbanisation, which has resulted in a more polluted environment than in other nations. The economic production per capita in these nations has increased as a result of increased urbanisation. These nations pay more attention to limiting the negative consequences of urbanisation, which they do by using more renewable energy and reducing emissions. The general population's health in these nations is severely impacted by increasing levels of urbanisation, which also has substantial implications on CO_2 emissions.

Next, it is found that there is a positive and significant relationship between energy used (LEU) and LCO_2 for both in the short run and long run. In brief, a 1% increase in LEU increases LCO_2 by 1.13% in the long run because more energy consumption can increase the scale of an economy and stimulate CO_2 emissions. Similar findings are shown by Tiwari et al. (2013), Shahbaz et al. (2015), and Shahbaz et al. (2014) for India and Bangladesh, respectively. Coal, crude oil, and gas make up the majority of India's energy mix, which is utilised for transportation, electricity generation, and the manufacture of steel and cement. There is a casual relationship between energy use and carbon emissions in India. Since coal accounts for the majority of India's commercial energy needs, the source of CO_2 emissions that is most efficient is coal. Energy consumption and India's economic growth are correlated, implies a relationship between economic activity and energy usage a high level of economic growth results in a high degree of energy use and vice versa.

Lastly, Trade openness (LTO) has a significant relationship with carbon emissions (LCO_2) in the long run. A 1% increase in LTO increases the emissions release by 0.07%. The outcome for India indicates that trade openness contributes to the depletion of resources and deterioration of the environment rather than to

Table 2: Unit root results

Variables	ADF t-statistic	p-value	PP t-statistic	p-value
LC	−2.62	0.02	7.38	0.02
LU	−4.23	0.02	5.70	0.02
LFD	1.75	0.72	1.83	0.79
LEU	0.16	0.99	0.78	0.98
LTO	−2.33	0.03	4.42	0.02
ΔLC	−3.54	0.00	19.52	0.00
ΔLU	−10.43	0.00	19.80	0.00
ΔLFD	−5.92	0.00	48.12	0.00
ΔLEU	−6.15	0.00	48.15	0.00
ΔLTO	−4.71	0.00	39.31	0.00

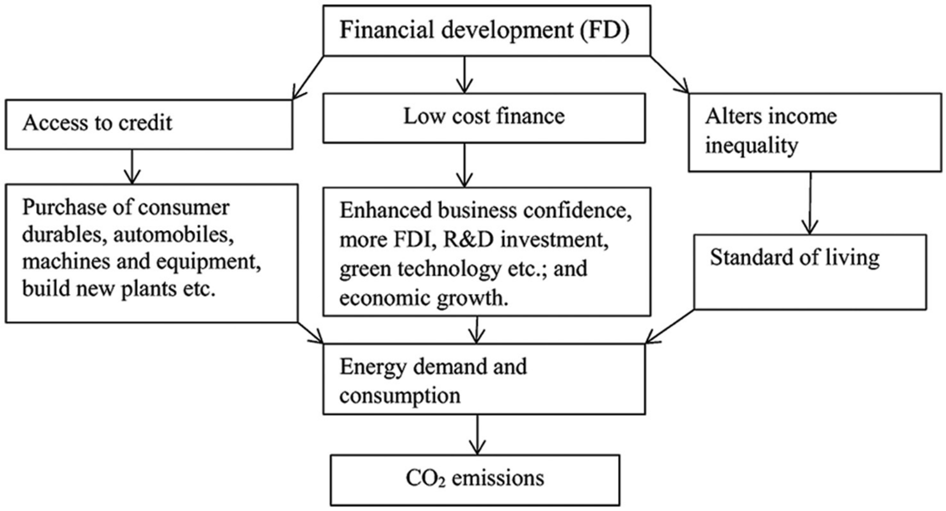
Source: Author's own calculations

Table 3: Bounds test results

Test statistic	Value	Significance	I (0)	I (1)
F-statistic	11.93	10%	2.45	3.25
		5%	2.86	4.01
		1%	3.74	5.02

Source: Author`s own calculations

Figure 1: Linkage between FD and CO_2 emissions



improvements in the use of resources. This result confirms the finding of Jayanthakumaran et al. (2012) and Boutabba (2014) in the case of India.

In conclusion, the long-run relationship of the model was validated by the fact that the error correction term had a negative and statistically significant value (ECT). ECT is a reflection of the speed of adjustment the model is capable of, and the negative value indicates that the variables in the model will converge in the space of long run. The rate of adjustment that was measured for the model that was proposed is 0.80. Approximately 80% of the previous period's disequilibria convergence of the previous year's shock to the long-run equilibrium of the current year (Tables 4 and 5).

4.4. Diagnostic Tests

After that, a series of diagnostic tests were carried out to make certain that the output of the model does not produce any spurious results (Table 6). The results show that there is no evidence of serial correlation in the proposed model, nor is there any heteroscedasticity effect in the disturbances. In addition, the model's specifications are accurately specified, as evidenced by the fact that the p-value of all of the tests is higher than the significant level of 10%. On the other hand, the model did not pass the normality test, which suggests that its data are not normally distributed. It is considered an optional test, despite the fact that this scenario is typical for ARDL-based models.

In order to ensure that the model is accurate, the CUSUM (Figure 2) and CUSUM of Square (CUSUMSQ) (Figure 3) calculations are carried out. These calculations confirm that the model's parameters remain constant. Given that the blue line is situated between the two dotted red lines in the graphs, the proof that the model is structurally stable at a significance level of 5% is provided by the graphs that follow. It is thought, based on the results of the diagnostic tests that were confirmed, that the model that was proposed in this study may produce trustworthy and solid outcomes for policymakers. This belief is supported by the findings of the current study.

Figure 2: CUSUM

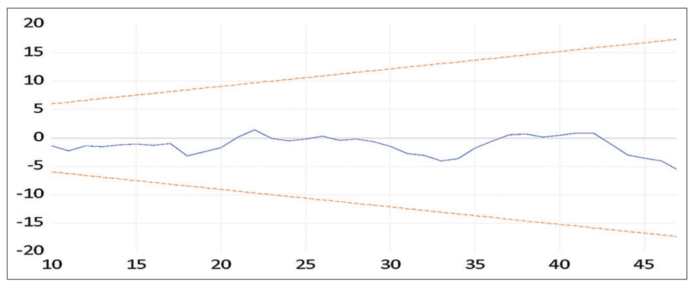


Figure 3: CUSUMSQ

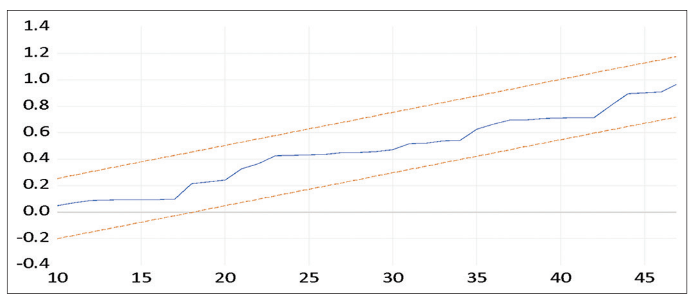


Table 4: Long-run coefficients

Variable	Coefficient	Std. Error	t-statistic	p-value
LFD	0.80	0.02	3.36	0.00
LU	1.53	0.14	10.25	0.00
LEU	1.13	0.07	14.54	0.00
LTO	0.07	0.02	2.87	0.00

Source: Author`s own calculations

Table 5: Error correction model

Variable	Coefficient	Std. error	t-statistic	p-value
CointEq(−1)	−0.80	0.12	6.64	0.00

Source: Author's own calculations

Table 6: Diagnostic tests

Serial correlation (P)	Heteroscedasticity (P)	Normality (P)	Functional form (P)
2.13 (0.144)	0.56 (0.801)	7.75 (0.022)	2.55 (0.20)

Source: Author's own calculations

5. CONCLUSION

Developing nations such as India, which are at a larger risk as a result of the phenomenon of climate change, face a significant obstacle in the form of this problem. Because of India's concerns about the effects of climate change, the country's government came up with the National Action Plan on Climate Change. This document includes eight missions that are both adaptative and mitigating in character. India has registered with the UN Framework Convention on Climate Change (UNFCCC) its voluntary endeavour to reduce the emissions intensity of its GDP by 20-25% by 2020 in comparison to the level in 2005 while simultaneously pursuing the path of inclusive growth. This was done as part of international efforts to mitigate climate change. As a result, it is essential to have a better understanding of the factors that contribute to India's GHG emissions in order to take action against these pollutant emissions and to ensure that India's economic development would be sustainable.

Using annual data spanning the years 1960-2020, this study examines how India's financial development, trade openness economic growth, urbanization, investment and energy consumption have contributed to the country's rate of environmental deterioration (in the form of CO_2 emissions). The examination of the impact that financial growth and trade openness have had on carbon emissions is the primary contribution that we have made to the existing body of work on Indian studies. The ARDL Bounds testing method for analyzing cointegration has been used throughout the process of determining both the long-run and the short-run dynamics. According to the findings, all of the factors have the potential to cause damage to the environment over the course of time.

The discovery that financial growth has a long-run positive influence on per capita CO_2 emissions is certainly the most important conclusion, demonstrating that financial development leads to environmental degradation in the context of India. As a result, the recommendation for public policy is that the operating procedures of the financial system should take into account the impact on the environment. For instance, the banking sector may incentivize investments in energy-efficient technology by providing interest rate reductions and including carbon-related requirements into the terms of their various financial products, such as term loans for business vehicles and investment real estate. As a result, a collection of workable regulations and incentives that encourage more low-carbon finance is an essential component of the process of constructing a society in India that values the conservation of its natural resources. India has to work on establishing a reliable financial system that will allow its enterprises to take advantage of cutting-edge and productive technology, cut their overall energy consumption, and contribute to the betterment of the environment. In order to improve environmental performance through the financial system, policymakers need to propose reforms to the financial system that promote and reward enterprises that use environmentally sustainable technology that are both effective and efficient. This will encourage firms to use ecologically sustainable technologies so that they can reap financial incentives, reduce their energy consumption, and cut their emissions of GHGs.

In a similar vein, growing urbanisation has resulted in the residential sector becoming the industry that consumes the most energy. For the sake of a cleaner environment, it is recommended that consumers be encouraged to purchase solar energy systems and appliances that have a lower impact on the environment in terms of their energy consumption. The development of energy-efficient policies that contribute to the reduction of carbon emissions should be the primary emphasis of those who are responsible for making policy; however, this should not come at the expense of productivity. Due to the fact that India is still in the process of developing, it would be disastrous for the country's economy if carbon emissions had to be reduced. This is because, if this were to happen, it would imply that India would no longer be in a position to actively participate in achieving adequate levels of productivity. Changes in energy policy can be accounted for in trade policy, and green trade policies can help to raise environmental standards. India needs to pay close attention to the usage of clean coal technologies and make an effort to switch from coal to alternative, cleaner energy sources including natural gas, nuclear, renewable, and hydrogen energy in order to change this unidirectional causal relationship. By taking such steps, India would be able to continue pursuing its goals for future growth and the implementation of its National Action Plan on Climate Change (NAPCC, 2008).

According to the findings, India experience environmental deterioration as a result of trade openness. Tariffs may be imposed on goods made with non-environmentally friendly energy since further trade liberalisation in India may be harmful to the environment.

In 2008, India issued what it called its "National Action Plan on Climate Change," or NAPCC, in an effort to mitigate the effects of climate change. India made a commitment to reduce its emissions by 33-35% by the year 2030 from their levels in 2005, and to raise its capacity to generate electricity from sources other than fossil fuels to 40%, when it signed the Paris Agreement in 2015 (UNFCC 2015a). However, in order to fulfill its obligation to address climate change in accordance with this commitment by the year 2030, India will require a minimum of 2.5 trillion US dollars (UNFCC 2015b). As a consequence of the findings, we have come to the conclusion that increased financial openness has a positive impact on environmental deterioration in India.

REFERENCES

Abbasi, F., Riaz, K. (2016), CO2 emissions and financial development in an emerging economy: An augmented VAR approach. Energy Policy, 90, 102-114.

Acharya, M. (2003), Development of the financial system and its impact on poverty alleviation in Nepal. Economic Review, 15(1), 134-164.

Ahmad, M., Khan, Z., Ur Rahman, Z., Khan, S. (2018), Does financial development asymmetrically affect CO2 emissions in China? An application of the nonlinear autoregressive distributed lag (NARDL), model. Carbon Management, 9(6), 631-644.

Ali, R., Bakhsh, K., Yasin, M.A. (2019), Impact of urbanization on CO2 emissions in emerging economy: Evidence from Pakistan. Sustainable Cities and Society, 48, 101553.

Al-Mulali, U., Solarin, S.A., Ozturk, I. (2016), Investigating the presence of the environmental Kuznets curve (EKC), hypothesis in Kenya: An autoregressive distributed lag (ARDL), approach. Natural Hazards, 80(3), 1729-1747.

Apergis, N., Payne, J.E. (2009), Energy consumption and economic growth in Central America: evidence from a panel cointegration and error correction model. Energy Economics, 31(2), 211-216.

Aye, G.C., Edoja, P.E., Charfeddine, L. (2017), Effect of economic growth on CO_2 emission in developing countries: Evidence from a dynamic panel threshold model. Cogent Economics and Finance, 5(1), 1379239.

Azam, M., Khan, A.Q., Zaman, K., Ahmad, M. (2015), Factors determining energy consumption: evidence from Indonesia, Malaysia and Thailand. Renewable and Sustainable Energy Reviews, 42:1123-1131.

Barua, A., Chakraborty, D. (2006), Liberalization, Trade and Industrial Performance: An Empirical Analysis of India. In: APEA Conference, Seattle.

Boutabba, M.A. (2014), The impact of financial development, income, energy and trade on carbon emissions: Evidence from the Indian economy. Economic Modelling, 40, 33-41.

Copeland, B.R., Taylor, M.S. (2004), Trade, growth, and the environment. Journal of Economic Literature, 42(1), 7-71.

Dash, R.K. (2009), Revisited export-led growth hypothesis: An empirical study on India. South Asia Economic Journal, 10(2), 305-324.

Dhakal, S. (2009), Urban energy use and carbon emissions from cities in China and policy implications. Energy Policy, 37(11), 4208-4219.

Dickey, D.A., Fuller, W.A. (1979), Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association, 74(366), 427-431.

Fan, Y., Liu, L.C., Wu, G., Wei, Y.M (2006). Analyzing impact factors of CO2 emissions using the STIRPAT model. Environmental Impact Assessment Review, 26(4) , 377-395.

Frankel, J.A., Romer, D.H. (1999), Does trade cause growth? American Economic Review, 89(3), 379-399.

G.I.M. Finance. Economic Survey 2011-12. OUP India, ISBN: 9780198085515, 2012

Ghazouani, T., Boukhatem, J., Sam, C.Y. (2020), Causal interactions between trade openness, renewable electricity consumption, and economic growth in Asia-Pacific countries: Fresh evidence from a bootstrap ARDL approach. Renewable and Sustainable Energy Reviews, 133, 110094.

Ghosh, S. (2010), Examining carbon emissions economic growth nexus for India: A multivariate cointegration approach. Energy Policy, 38(6), 3008-3014.

Halicioglu, F. (2009), An econometric study of CO2 emissions, energy consumption, income and foreign trade in Turkey. Energy Policy, 37(3), 1156-1164.

Intergovernmental Panel on Climate Change. (2007), Climate Change 2007. In: Core Writing Team, Pachauri, R.K., Reisinger, A. editors. Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland: Intergovernmental Panel on Climate Change. p104.

Jalil, A., Feridun, M. (2011), The impact of growth, energy and financial development on the environment in China: A cointegration analysis. Energy Economics, 33(2), 284-291.

Jalil, A., Mahmud, S.F. (2009), Environment Kuznets curve for CO2 emissions: A cointegration analysis for China. Energy Policy, 37(12), 5167-5172.

Jayanthakumaran, K., Verma, R., Liu, Y. (2012), CO2 emissions, energy consumption, trade and income: A comparative analysis of China and India. Energy Policy, 42, 450-460.

Jensen, V.M.H. (1996), The Pollution haven Hypothesis and the Industrial Flight Hypothesis: Some Perspectives on Theory and Empirics. Norway: University of Oslo, Centre for Development and the Environment Paper, 19965.

Jiang, C., Ma, X. (2019), The impact of financial development on carbon emissions: A global perspective. Sustainability, 11(19), 5241.

Jun, W., Mahmood, H., Zakaria, M. (2020), Impact of trade openness on environment in China. Journal of Business Economics and Management, 21(4), 1185-1202.

Kahrl, F., Roland-Holst, D. (2009), Growth and structural change in China's energy economy. Energy, 34(7), 894-903.

Keho, Y. (2017), The impact of trade openness on economic growth: The case of Cote d'Ivoire. Cogent Economics and Finance, 5, 1-14.

Khan, A.Q., Saleem, N., Fatima, S.T (2018), Financial development, income inequality, and CO2 emissions in Asian countries using STIRPAT model. Environmental Science and Pollution Research International, 25(7), 6308-6319.

Khan, M.K., Khan, M.I., Rehan, M. (2020a), The relationship between energy consumption, economic growth and carbon dioxide emissions in Pakistan. Financial Innovation, 6(1),1-13.

Khan, M.K., Teng, J.Z., Khan, M.I., Khan, M.O. (2019c), Impact of globalization, economic factors and energy consumption on CO2 emissions in Pakistan. The Science of the Total Environment, 688, 424-436.

Kohler, M. (2013), CO2 emissions, energy consumption, income and foreign trade: A South African perspective. Energy Policy, 63, 1042-1050.

Komal, R., Abbas, F. (2015), Linking financial development, economic growth and energy consumption in Pakistan. Renewable and Sustainable Energy Reviews, 44, 211-220.

Kraft, J., Kraft, A. (1978), On the Relationship between energy and GNP. Journal of Energy Development, 3, 401-403.

Kwame, P. (2013), Trade liberalisation and growth: The Ghanaian experience. Journal of Economics and Sustainable Development, 4, 125-135.

Lahiani, A. (2020), Is financial development good for the environment? An asymmetric analysis with CO2 emissions in China. Environmental Science and Pollution Research International, 27(8), 7901-7909.

Lau, E., Chye, X. H., & Choong, C. K. (2011). Energy-growth causality: Asian countries revisited. International Journal of Energy Economics and Policy, 1(4), 140-149.

Liang, Q.M., Fan, Y., Wei, Y.M. (2009), The effect of energy end-use efficiency improvement on China's energy use and CO2 emissions: A CGE model-based analysis. Energy Efficiency. 2, 243-262.

Lin, F. (2017), Trade openness and air pollution: City-level empirical evidence from China. China Economic Review, 45, 78-88.

Liu, X., Bae, J. (2018), Urbanization and industrialization impact of CO2 emissions in China. Journal of Cleaner Production, 172, 178-186

Marelli, E., Signorelli, M. (2011), China and India: Openness, trade and effects on economic growth. The European Journal of Comparative Economics, 8(1), 129-154.

Masih, A.M.M., Masih, R. (1996), Energy consumption, real income and temporal causality: Results from a multi-country study based on cointegration and error correction modeling techniques. Energy Economics, 18(3), 165-183.

Narayan, P.K., Singh, B. (2007), The electricity consumption and GDP nexus for the Fiji Islands. Energy Economics, 29(6), 1141-1150.

National Action Plan on Climate Change (NAPCC). (2008), New Delhi: Ministry of Environment and Forests Government of India.

Nduka, K.E. (2013), Openness and economic growth in Nigeria. Journal of Education and Practice, 4(1), 68-73.

Odhiambo, N.M. (2009), Savings and economic growth in South Africa: A multivariate causality test. Journal of Policy Modeling, 31(5), 708-718.

Ozturk, I. (2010), A literature survey on energy-growth nexus. Energy

Policy, 38(1), 340-349.
Ozturk, I., Acaravci, A. (2013), The long-run and causal analysis of energy, growth, openness and financial development on carbon emissions in Turkey. Energy Economics, 36, 262-267.
Pesaran, M.H., Shin, Y. (1995), An Autoregressive Distributed Lag Modeling Approach to Co-integration Analysis. Econometrics and Economic Theory in the 20st Century. The Ragnar Frisch Centennial Symposium. Vol. 31. Cambridge, United Kingdom: Cambridge University Press.
Pesaran, M.H., Shin, Y., Smith, R.J. (2001), Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289-326.
Phillips, P.C.B., Perron, P. (1988), Testing for a unit root in time series regression. Biometrika, 75(2),335-346.
Poumanyvong, P., Kaneko, S. (2010), Does urbanization lead to less energy use and lower CO2 emissions? A cross-country analysis. Ecological Economics, 70(2), 434-444.
Pradhan, R.P. (2010), Energy consumption-growth nexus in SAARC countries: Using cointegration and error correction model. Modern Applied Science, 4(4), 74.
Sajeev, A., Kaur, S. (2020), Environmental sustainability, trade and economic growth in India: implications for public policy. International Trade Politics and Development, 4(2), 141-160.
Sehrawat, M, Giri, A.K, Mohapatra, G. (2015), The impact of financial development, economic growth and energy consumption on environmental degradation evidence from India. Management of Environmental Quality an International Journal, 26(5), 666-682.
Shahbaz, M, Haouas, I, Van Hoang, TH. (2019), Economic growth and environmental degradation in Vietnam: Is the environmental Kuznets curve a complete picture? Emerging Markets Review, 38, 197-218.
Shahbaz, M, Jam, F.A., Bibi, S., Loganathan, N. (2016a), Multivariate granger causality between CO2 emissions, energy intensity and economic growth in Portugal: Evidence from cointegration and causality analysis. Technological and Economic Development of Economy, 22(1), 47-74.
Shahbaz, M., Dube, S., Ozturk, I., Jalil, A. (2015), Testing the environmental Kuznets curve hypothesis in Portugal. International Journal of Energy Economics and Policy, 5(2), 475-481.
Shahbaz, M., Lean, H.H., Farooq, A. (2013), Natural gas consumption and economic growth in Pakistan. Renewable and Sustainable Energy Reviews, 18(2), 87-94.
Shahbaz, M., Mallick, H., Mahalik, M.K., Sadorsky, P. (2016b), The role of globalization on the recent evolution of energy demand in India: Implications for sustainable development. Energy Economics, 55, 52-68.
Shahbaz, M., Nasreen, S., Ahmed, K., Hammoudeh, S. (2017), Trade openness-carbon emissions nexus: The importance of turning points of trade openness for country panels. Energy Economics, 61, 221-232.
Shahbaz, M., Rahman, M.M. (2012), The dynamic of financial development, imports, foreign direct investment and economic growth: Cointegration and causality analysis in Pakistan. Global Business Review, 13(2), 201-219.
Shahbaz, M., Solarin, S.A., Mahmood, H., Arouri, M. (2013), Does financial development reduce CO2 emissions in Malaysian economy? A time series analysis. Economic Modeling, 35, 145-152.
Shahbaz, M., Uddin, G.S., Ur Rehman, I., Imran, K. (2014), Industrialization, electricity consumption and CO2 emissions in Bangladesh. Renewable and Sustainable Energy Reviews, 31, 575-586.
Sharma, K., Bhattarai, B., Ahmed, S. (2019), Aid, growth, remittances and carbon emissions in Nepal. The Energy Journal, 40(1), 129-141.
Tiwari, A.K., Shahbaz, M., Hye, M.Q.A. (2013), The environmental Kuznets curve and the role of coal consumption in India: Cointegration and causality analysis in an open economy. Renewable and Sustainable Energy Reviews, 18, 519-527
Topalova, P.B. (2004), Trade Liberalization and Firm Productivity: The Case of India. IMF Working Paper No. 04/28. Washington, D.C.: International Monetary Fund.
UNFCCC (2015a), Adoption of the Paris Agreement. United Nations Office at Geneva, Geneva.
UNFCCC (2015b), India's Intended Nationally determined contribution: working towards climate justice United Nations Framework Convention Climate Change.
Vidyarthi, H. (2013), Energy consumption, carbon emissions and economic growth in India. World Journal of Science Technology and Sustainable Development, 10(4), 278-287.
Wang, Q., Zhang, F. (2021), The effects of trade openness on decoupling carbon emissions from economic growth-evidence from 182 countries. Journal of Cleaner Production, 279, 123838.
Wawrzyniak, D., Doryń, W. (2020), Does the quality of institutions modify the economic growth-carbon dioxide emissions nexus? Evidence from a group of emerging and developing countries. Economic Research-Ekonomska Istraživanja, 33(1), 124-144.
Wen, H., Dai, J. (2020), Trade openness, environmental regulation, and human capital in China: based on ARDL cointegration and granger causality analysis. Environmental Science and Pollution Research International, 27(2), 1789-1799.
Wolde-Rufael, Y. (2006), Electricity consumption and economic growth: A time series experience for 17 African countries. Energy Policy, 34(10), 1106-1114.
World Bank. (2019), Available from: https://www.worldbank.org
Xing, T., Jiang, Q., Ma, X. (2017), To facilitate or curb? The role of financial development in China's carbon emissions reduction process: A novel approach. International Journal of Environmental Research Public Health, 14(10), 1222.
Xu, Z., Baloch, M.A., Danish., Meng, F., Zhang, J., Mahmood, Z. (2018), Nexus between financial development and CO2 emissions in Saudi Arabia: Analyzing the role of globalization. Environmental Science and Pollution Research International, 25(28), 28378-28390.
Yang, H.Y. (2000), A note on the causal relationship between energy and GDP in Taiwan. Energy Economics, 22(3), 309-317.
York, R., Rosa, E.A., Dietz, T. (2003), STIRPAT, IPAT and ImPACT: Analytic tools for unpacking the driving forces of environmental impacts. Ecological Economics, 46(3), 351-365.
Yuxiang, K., Chen, Z. (2011), Financial development and environmental performance: Evidence from China. Environment Development Economics, 16(6), 1-19.
Zhang, C., Lin, Y. (2012), Panel estimation for urbanization, energy consumption and CO2 emissions: A regional analysis in China. Energy Policy, 49, 488-498.
Zhang, Y.J. (2011), The impact of financial development on carbon emissions: An empirical analysis in China. Energy Policy, 39(4), 2197-2203.
Ziaei, S.M. (2015), Effects of financial development indicators on energy consumption and CO2 emission of European, East Asian and Oceania countries. Renewable and Sustainable Energy Reviews, 42, 752-759.