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IMPACTS OF URBANIZATION AND ENERGY CONSUMPTION ON CLIMATE CHANGE IN PAKISTAN

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ABSTRACT

Internal migration from rural to urban areas has been observed for a couple of years, which creates environmental issues. The aim is to scan the influence of urbanization, energy use and economic growth on climate change of Pakistan for 1980-2015, using ARDL and granger causality test. The findings show the long-run relationship between urbanization, economic growth, energy, and climate change. In the long run, energy use and urbanization are increasing carbon and affecting climate. The short-run results of the causality test indicate unidirectional causality from urbanization to economic growth, to climate change, and to energy consumption. The findings also suggest the one-directional causation from growth to CO_2 emissions and energy. In the long run, causality shows unidirectional causality from urbanization and economic growth to capital, trade energy consumption and to CO_2. The bidirectional causality also exits between energy consumption and climate change.

Disciplinary: Multidisciplinary (Earth and Environmental Sciences (Climate Change), Economic Science, Energy Science, Sustainability and BioScience (Carbon Emissions), Urbanization, Migration, and Mobility Studies).

1. INTRODUCTION

In the last two decades, a large number of households have been migrated from rural to urban areas. The expansion of industry causes urbanization as it creates employment opportunities. Internal migration also arises due to some other reasons, e.g. lack of health facilities, lack of quality and higher education, low living standard and backwardness in rural areas, etc. Food expenditures are also rising in rural areas (Habib et al., 2016). The Government of Pakistan is also indirectly involved in the

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increasing trend of urbanization because of a lack of concentration on rural development. According to the report of the economic survey of Pakistan (2018), the trend of the population decreased in rural areas from 62.1% in 2013 to 59.46% in 2017, while, the urban population's share increased from 37.9% in 2013 to 40.54% in 2017.

The rising trend of urbanization causes various problems such as congestion, excess labor supply in urban areas and especially it creates environment-related issues (Siddique et al., 2016). Omri (2013) found that urbanization is an increasing factor in CO_2 emissions in Middle East and North African (MENA) countries.

The highest level of power resources is beneficial to a country as it accelerates production, trade and economic growth as well (Siddique & Majeed, 2015). Besides the incentives of power resources and energy consumption, the intensive use of energy is dangerous for the environment as it is one of the main reasons for increasing carbon emissions. The urbanization is also a causing factor of pollution, but better policies and institutions can improve the quality of the environment.

Urbanization pollutes the environment while it improves the environmental quality in the presence of good institutions and stable policies (Adams et al., 2016). According to Ponce and Marshall (2014), urbanization has an adverse influence on CO_2 emissions in the countries having a strong environmental protection policy. The study suggests that the impact of urbanization depends on the power of environmental policy. Shahbaz et al. (2014) bring into being one-directional causation running from urban population to carbon emissions. Omri (2013) found that urbanization is an increasing factor in CO_2 emissions in MENA countries for 1990-2011.

Urbanization has a weak impact on the environment at the initial level. According to Bekhet & Othman (2017), urbanization is increasing CO_2 emissions at early stages in Malaysia.

An economy can move towards development and modernization with flourishing the indusial sector. People move from rural to urban areas. A better industrial sector creates employment opportunities in an economy as a result people migrate from rustic to towns. That kind of migration is good to a level and creates many problems if it exceeds the specific level. The industry uses power resources (energy) and releases various harmful gases like carbon dioxide.

The study focuses on the effects of usage of energy on CO_2 emissions by add-in an urban population in Pakistan. The objective is to find the influence of urbanization, energy and economic growth on climate change, and to investigate the causal relationship in Pakistan.

2. LITERATURE REVIEW

2.1 URBANIZATION, ENERGY USE, AND CLIMATE CHANGE

In the literature, CO_2 emissions are used as a proxy of climate change (see, for instance, Nawaz et al., 2016). Adams et al. (2016) established a nexus between urbanization and CO_2 emissions in Ghana for 1965-2011. The findings suggest that urbanization pollutes the environment while it improves the quality of the environment in the presence of good institutional governance.

Bekhet & Othman (2017) found that urbanization has a positive impact on CO_2 emissions at early stages in Malaysia from 1971 to 2015. The causality outcomes exposed the unidirectional impact from urbanization to CO_2 emissions. He et al. (2017) scrutinized the effect of urbanization on emissions of CO_2 from energy consumption for China for 1995-2013. The results exposed a U-curved affiliation among urbanization and CO_2 emissions. The study also suggests that the results vary from region to region.

Siddique et al. (2016) investigated the presence of two-way causality between urbanization and CO_2, and among energy and CO_2 emissions in South Asia for 1983-2013. Al-Mulali & Ozturk (2015) investigated that urbanization damages the environment in MENA countries over the time period of 1996 to 2012. Shahbaz et al. (2014) found a one-way causality from urbanization to carbon in UAE over 1975-2011, using the ARDL.

Ponce & Marshall (2014) explored that urbanization has a weak negative impact on CO_2 emissions in the countries having a strong environmental protection policy. The study also suggests that the impact of urbanization depends on the power of environmental policy. Similarly, Omri (2013) found that urbanization is an increasing factor in carbon dioxide emissions in MENA countries from 1990 to 2011.

Hossain (2011) explored one-sided relationships from urbanization to economic growth in the short-run in industrial economies over 1971-2007.

Li & Lin (2015) traced the relationship between urbanization, energy and CO_2 emissions for a panel of 73 nations over 1971-2010. The study divided the panel into four groups. The results express that urbanization is an increasing indicator of CO_2. Xu & Lin (2015) showed that the existence of an inverted u-shaped non-1inear relationship between industrialization and CO_2 emissions for China over 1990-2011. In the eastern region, an inverted u shaped pattern followed by urbanization. Western regions followed a positive U-shaped pattern, while the central region follows the same as in the western arena.

Wang et al. (2017) showed that socioeconomic factors correlate significantly with CO_2 emissions for four big cities of China i.e. Beijing, Tianjin, Shanghai and Guangzhou for the period of 1990-2010.

A substantial body of literature found the positive impact of energy consumption and the urban population on CO_2. In some cases, the relationship between urbanization and CO_2 emissions, for example, Ali et al. (2016) investigated that urbanization has not been a statistically noteworthy impact on CO_2 whereas energy and growth have a significant impact on CO_2 in Nigeria for 1971-2011, using ARDL approach. In contrast, Wang et al. (2018) investigated that planning about urbanization increases the carbon emission in Taipei.

2.2 CLIMATE CHANGE, ENERGY, AND ECONOMIC GROWTH

Energy consumption, trade, and economic growth have also an influence on climate change. In the literature, the results vary from region to region as in some economies the mentioned indicators have a positive impact on CO_2 and negative in others. Shahbaz et al. (2013) expressed that energy use and economic growth are the increasing factors of CO_2 emissions, and trade is good for the environment. The granger causality test indicates a two-sided association between energy and CO_2, and between the growth of an economy and CO_2.

Begum et al. (2015) probed roles of GDP growth and energy use on carbon emissions in Malaysia, using the ARDL bounds testing method. The results traced that initially, economic growth declines CO_2 emissions from 1970-1980, and it increases emissions in 1980-2009. In the long run, economic growth is an accelerating factor of CO_2 emissions.

Zhang & Cheng (2009) exposed unidirectional causality from growth to energy, and energy is an increasing factor of carbon emissions in China over 1960-2007. The results also express that both energy and carbon do not affect growth. The aim of this research is to find out the fresh evidence on

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the nexus among CO_2 emissions and urbanization in Pakistan for policy-making perspectives.

3. THEORETICAL FRAMEWORK AND METHODOLOGY

Energy is an accelerating factor of production. On the other hand, the increasing level of energy consumption and urbanization creating some environment-related issues. This study re-examines the impression of urban population and energy use on the environment, incorporating the growth of Pakistan. It also examined how trade affects the climate (CO_2 emissions). In literature, CO_2 emissions are used as the alternative variable of climate change (Nawaz et al., 2016).

Many studies have explored the relationship between CO_2 emissions, energy consumption, and growth (Alam et al., 2012). Recently, Omri, A. (2013) has incorporated trade in growth model but Shahbaz et al. (2013) emphasized financial development in this regard. Hossain (2011) stressed on the dynamic link among urban population and CO_2 emissions.

According to the literature, economic growth, trade, energy, and urbanization have an influence on climate change (see, e.g. Section 2). The climate change function is given as

$$CO = f\ (K, E, UR, Y, T) \quad (1).$$

The climate change (CO) is our dependent variable, capital (K), energy consumption (E), urbanization (UR), economic growth (Y) and trade (T) are independent variables. The general form is modeled as

$$CO_t = A\ K_t^{\beta_1}\ E_t^{\beta_2}\ UR_t^{\beta_3}\ Y_t^{\beta_4}\ T_t^{\beta_5} \quad (2).$$

To linearize Equation (2), the natural log is used as

$$lnCO_t = \beta_0 + \beta_1 lnK_t + \beta_2 lnE_t + \beta_3 lnUR_t + \beta_4 lnY_t + \beta_5 lnT_t + \varepsilon_t \quad (3),$$

where, ln: Natural logarithm, CO: Climate change (CO_2 emissions), K: Capital, E: Energy consumption, UR: Urbanization; Y: Economic growth, T: Trade, β_0: Intercept, β_1 : Capital elasticity of climate change, β_2: Elasticity of energy consumption with respect to climate change, β_3: Urbanization elasticity of climate change, β_4: Elasticity of economic growth with respect to climate change, β_5: Elasticity of trade, & t = time period from 1980 to 2015. The symbol ε is the model error term.

4. METHODOLOGY

To catch interactions between urbanization, consumption of energy and climate change (CO_2) in the short and the long run. The relevant techniques and methods are discussed in this section. First, we determine the order of integration of variables by applying the ADF unit root test. The suitable technique for the model is the ARDL bounds testing co-integration approach. To check the direction, VCM is used and stability diagnostic tests are applied. ARDL is a single equation approach which gives the relationship between variables in the long and short run.

ARDL does not identify the causality direction. Engle and Granger (1987) developed an approach for finding the granger causality relationship. In this approach all variables at first difference form are used as dependent and independent variables by adding lags for short-run granger causality, variables are used in different forms. The error correction term (ECT) is used for a long-run causal relationship as equations of VECM granger causality (Equation (4)).

$$\begin{bmatrix} \Delta lnCO_t \\ \Delta lnK_t \\ \Delta lnE_t \\ \Delta lnUR_t \\ \Delta lnY_t \\ \Delta lnT_t \end{bmatrix} = \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \\ \beta_5 \\ \beta_6 \end{bmatrix} + \begin{bmatrix} \alpha_{11,1} & \alpha_{12,1} & \alpha_{13,1} & \alpha_{14,1} & \alpha_{15,1} & \alpha_{16,1} \\ \alpha_{21,1} & \alpha_{22,1} & \alpha_{23,1} & \alpha_{24,1} & \alpha_{25,1} & \alpha_{26,1} \\ \alpha_{31,1} & \alpha_{32,1} & \alpha_{33,1} & \alpha_{34,1} & \alpha_{35,1} & \alpha_{36,1} \\ \alpha_{41,1} & \alpha_{42,1} & \alpha_{43,1} & \alpha_{44,1} & \alpha_{45,1} & \alpha_{46,1} \\ \alpha_{51,1} & \alpha_{52,1} & \alpha_{53,1} & \alpha_{54,1} & \alpha_{55,1} & \alpha_{56,1} \\ \alpha_{61,1} & \alpha_{62,1} & \alpha_{11,1} & \alpha_{11,1} & \alpha_{11,1} & \alpha_{11,1} \end{bmatrix} \begin{bmatrix} \Delta lnCO_{t-1} \\ \Delta lnK_{t-1} \\ \Delta lnE_{t-1} \\ \Delta lnUR_{t-1} \\ \Delta lnY_{t-1} \\ \Delta lnT_{t-1} \end{bmatrix} \ldots +$$

$$\begin{bmatrix} \alpha_{11,k} & \alpha_{12,k} & \alpha_{13,k} & \alpha_{14,k} & \alpha_{15,k} & \alpha_{16,k} \\ \alpha_{21,k} & \alpha_{22,k} & \alpha_{23,k} & \alpha_{24,k} & \alpha_{25,k} & \alpha_{26,k} \\ \alpha_{31,k} & \alpha_{32,k} & \alpha_{33,k} & \alpha_{34,k} & \alpha_{35,k} & \alpha_{36,k} \\ \alpha_{41,k} & \alpha_{42,k} & \alpha_{43,k} & \alpha_{44,k} & \alpha_{45,k} & \alpha_{46,k} \\ \alpha_{51,k} & \alpha_{52,k} & \alpha_{53,k} & \alpha_{54,k} & \alpha_{55,k} & \alpha_{56,k} \\ \alpha_{61,k} & \alpha_{62,k} & \alpha_{11,k} & \alpha_{11,k} & \alpha_{11,k} & \alpha_{11,k} \end{bmatrix} \begin{bmatrix} \Delta lnCO_{t-k} \\ \Delta lnK_{t-k} \\ \Delta lnE_{t-k} \\ \Delta lnUR_{t-k} \\ \Delta lnY_{t-k} \\ \Delta lnT_{t-k} \end{bmatrix} + \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \\ \lambda_5 \\ \lambda_6 \end{bmatrix} ECT_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix} \quad (4),$$

where Δ is the first difference, βs are the intercepts, and k is lag length, ε for error terms and the variables have been explained in the methodology section. The ECT terms interpret the long-run causality relationship and adjustments. The term ECT is obtained by the residuals from equation (3). The coefficient of variables expressed the short-run dynamics and the coefficient of ECT_{t-1} shows the long-run causal relationship.

5. DATA

The dependent variable of the study, i.e. per capita carbon dioxide emissions (metric tons) is used as a proxy of climate change (see e.g., Jalil & Feridun, 2011; Nawaz et al., 2016).

The independent variables include gross capital formation as a share of GDP (Shahbaz, et al. 2013), energy consumption per capita, urban population as urbanization, trade as a share of GDP, and per capita GDP at constant price 2010 US$ as economic growth (Omri, 2013; Siddique & Majeed, 2016; & Siddique et al., 2018). Data is taken from WDI and variables are used in natural logarithm form.

5.1 DESCRIPTIVE ANALYSIS

Table 1 shows the descriptive statistics. The average value of CO_2 is -0.347, the minimum score is -0.889 and the maximum value is 0.006. The average capital (share of GDP) is 2.876. The average energy use is 0.143 and the average value of urbanization (urban population as a share of total) is 17.540. The detail of all variables is given in Table 1.

Table 1: Descriptive Statistics

Variables	CO_2	K	E	UR	Y	T
Mean	-0.347	2.876	6.060	17.540	6.720	3.522
Median	-0.299	2.912	6.106	17.561	6.720	3.530
Max.	0.006	3.035	6.260	18.109	7.041	3.661
Min.	-0.889	2.647	5.759	16.902	6.321	3.317
St. Dev.	0.268	0.097	0.143	0.354	0.202	0.081
Obs.	36	36	36	36	36	36

5.2 CORRELATION

CO_2 emissions show a positive correlation with energy, economic growth, and urbanization, while CO_2 is negatively correlated with capital and trade (Table 2).

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Table 2: Correlation Matrix.

Variables	CO_2	K	E	UR	Y	T
CO_2	1.000					
K	-0.511	1.000				
E	0.978	-0.438	1.000			
UR	0.976	-0.646	0.937	1.000		
Y	0.983	-0.564	0.944	0.960	1.000	
T	-0.361	0.640	-0.301	-0.443	-0.367	1.000

6. DISCUSSION

The estimation strategy is as follows: the first ADF test is applied check order of integration Second, the ARDL test is used for the confirmation of co-integration. Third, we have applied various tests to check diagnostics. Fourth, the granger causality approach is used for direction between variables.

6.1 RESULT OF UNIT ROOT TEST

Table 3 shows that the null hypothesis for all variables except energy and urbanization is not rejected at 5% level of significance.

Table 3: Result of Unit Root Test.

Variables	**With Intercept**		**With Trend and Intercept**	
	I(0)	I(1)	I(0)	I(1)
	t-statistics			
CO	-1.819	-7.433	-2.175	-4.965
K	-1.508	-5.896	-2.495	-5.826
E	-3.256	-	0.292	-5.277
UR	-0.862	-4.728	-3.564	-
Y	-0.917	-3.889	-2.597	-3.842
T	-2.269	-7.561	-2.773	-7.519

6.2 RESULT OF BOUNDS F-TEST

Table 4 shows the results of the ARDL bounds F-test for co-integration, it carries the lag length of variables, F-stat and critical values of bounds. The lag length of all variables used in our analysis is 4. The F-stat (19.61) is more than the critical value which confirms co-integration in the long run.

Table 4: Result of Bounds F-Test

Model	Lags	F-stat	Critical Value			
			at 1%		at 5%	
			I(0)	I(1)	I(0)	I(1)
CO, K, E, UR, Y, T	(4, 4, 4, 4, 4, 4)	19.616	3.41	4.68	2.62	3.79

6.3 ARDL CO-INTEGRATION RESULTS

In the short run, energy, urbanization, and trade are inversely correlated with CO_2, which implies that energy, trade, and urbanization are declining the level of emissions. Capital has also a negative impact on CO_2 emissions. Siddique (2017) also found a negative impact of capital and energy on CO_2 emissions in the short run. The short-run coefficients of energy, urbanization, and trade are significant at a 1% level of significance but capital is insignificant. On the other hand, economic growth is an increasing factor in CO_2 emissions and it has bad impacts on the climate of Pakistan (Shahbaz et al., 2013).

In the long run, energy consumption, urbanization, trade, and capital have a significant positive impact on CO_2 emissions while economic growth has a negative effect on CO_2. The coefficient of capital is 0.71 which implies that a 1% rise in capital formation causes a 0.71% increase in CO_2 emissions. The results are matched with literature (Alam et al., 2012; Jalil & Feridun, 2011; Omri, 2013). The coefficient of urbanization is 1.89, implies that a 1% rise in urbanization reasons a 1.89% increase in CO_2 emissions. Omri (2013) & Hossain (2011) also found the same results. The elasticity of energy is 0.91 which means 0.91% CO_2 emissions rise if energy rises by 1%. Alam et al. (2012), and Jalil & Feridun (2011) investigated the long-run impact of energy on CO_2 emissions.

The coefficient of economic growth (-1.98) shows a 1% intensification in economic growth sources a 1.98% decrease in emissions (Table 5). Begum et al. (2015) also found a negative impact of economic growth on CO_2 emissions. The results confirm a 1% increase in trade origins a 0.46% increase in carbon emissions (Siddique, 2017).

Table 5: Consequences of ARDL

Variables	Short Run Results		Long Run Results	
	Coeff.	Prob.	Coeff.	Prob.
CO (-4)	0.825	(0.209)		
K	-0.441	(0.236)	0.713	(0.097)
K (-4)	-0.421	(0.198)		
E	0.420	(0.573)	0.919	(0.093)
E (-4)	-1.931	(0.049)		
UR	9.136	(0.909)	1.895	(0.060)
UR (-4)	-43.006	(0.038)		
Y	-0.463	(0.462)	-1.988	(0.101)
Y (-4)	2.639	(0.082)		
T	0.198	(0.436)	0.469	(0.077)
T(-4)	-0.678	(0.038)		
Constant	-95.988	(0.077)	-30.110	(0.029)
RSS	0.002			
R^2	0.599			

6.4 RESULT OF RESIDUAL AND STABILITY DIAGNOSTICS

Table 6 contains the results of various tests of stability. The p-value of heteroskedasticity (χ^2_{HET}) test is insignificant that shows there is homoskedasticity. The results of serial correlation LM (χ^2_{LM}) test are also insignificant which expresses no autocorrelation. The results of the Ramsey reset test (χ^2_{RESET}) predict the functional form is good.

Table 6: Results of diagnostics.

Tests	F-stat	Prob.
χ^2_{LM}	0.380	0.542
χ^2_{HET}	1.082	0.535
χ^2_{RESET}	0.878	0.520

6.5 RESULT OF GRANGER CAUSALITY TEST

Table 7 contains the results of the direction of causality between CO_2 emissions and all independent variables.

The short-run results of Granger causality show a one-sided association from urbanization, energy, and growth to CO_2 emissions. Alam et al. (2012), Shahbaz et al. (2013) and Kohler (2013) found unidirectional causality from energy to CO_2 emissions. The findings exposed a unidirectional causality from urbanization to economic growth, Al-Mulali & Ozturk (2015), Bekhet & Othman (2017), and Hossain (2011) established one-directional causation form urbanization to economic

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growth. The unidirectional causality is running from urbanization to energy which shows that urbanization is one of the reasons to increase the use of energy resources.

The findings also expressed a unidirectional causality from urbanization and economic growth to capital. The results also indicate single direction causation from the capital to trade. One-way causality is also running from CO_2 emissions and energy consumption to capital.

The unidirectional causality is running from economic growth to energy consumption, which shows that economic growth is one of the reasons to increase the use of energy resources. Omri (2013) also investigated the two-way causality between economic growth and energy consumption. The environmental policies should design by incorporating economic growth, energy, trade, and urbanization.

Table 7: Results of Causality Test

Short-run Results						
Variables	ΔCO	ΔK	ΔE	ΔUR	ΔY	ΔT
ΔCO		2.390*	0.644	0.357	0.327	0.477
Prob.		(0.109)	(0.532)	(0.702)	(0.723)	(0.624)
ΔK	0.334		0.882	0.800	1.545	3.397*
Prob.	(0.718)		(0.424)	(0.458)	(0.230)	(0.047)
ΔE	1.424*	4.821*		0.112	0.209	1.481
Prob.	(0.057)	(0.015)		(0.893)	(0.812)	(0.244)
ΔUR	2.976*	2.645*	4.461*		3.198*	1.723
Prob.	(0.066)	(0.088)	(0.020)		(0.055)	(0.196)
ΔY	3.196*	9.316*	2.308*	0.201		2.100
Prob.	(0.055)	(0.001)	(0.107)	(0.819)		(0.140)
ΔT	0.480	0.062	0.355	0.567	0.862	
Prob.	(0.623)	(0.939)	(0.703)	(0.573)	(0.432)	
Long run Results						
ECT	-0.525*	0.972*	0.466*	-0.004	0.199	1.164*
Standard error	(0.250)	(0.420)	(0.152)	(0.004)	(0.143)	(0.555)

The long-run results also are shown in Table 7. The coefficients of error correction term show the long-run causal relationship among the variables. The positive sign of coefficients of ECT means error correction is not taking place, while the minus sign explains the speed of recovery in error to stability in the long run. The measurement of ECT is significant that exposed the causal relationship among the variables in the long run. The results show one-sided causality from urbanization and economic growth to climate change. The result explains that urbanization and the growth of an economy are polluting the environment and affecting the climate of Pakistan.

The results also expressed the bidirectional causality between climate change and capital, between energy and climate change, and between trade and climate change (CO_2) in the long run. The two-way causal relationship also exists among energy and capital, between trade and capital, and between trade and energy consumption.

7. CONCLUSION

The study investigates the effect of urbanization, economic growth and the usage of energy on climate change in Pakistan for 1980-2015 by employing the ARDL and causality approach. The results of the ARDL bounds F-test for co-integration confirm an actuality of long-run co-integration link between urbanization, energy consumption, economic growth and CO_2 emissions in Pakistan.

In the short run, energy consumption, urbanization, and trade have a negative and significant impact on CO_2 emissions, which implies that energy, trade, and urbanization are helpful to decrease the level of carbon emissions. Siddique (2017) also expressed a negative role of energy to CO_2 in the short run. On the other hand, economic growth has a positive and significant impact on carbon emissions in Pakistan.

In the long run, energy consumption, urbanization, trade, and capital have a significant positive impact on CO_2 emissions while economic growth has a negative impact on CO_2. The results are matched with literature (Alam et al., 2012; Jalil and Feridun, 2011; Omri, 2013).

The short-run results of causality show a one-way causality from urbanization, energy consumption and economic growth to CO_2 emissions. Alam et al. (2012), Shahbaz et al. (2013) and Kohler (2013) exposed unidirectional causality from energy consumption to CO_2 emissions. The findings exposed a unidirectional causality from urbanization to economic growth. This study results are consistent with the studies of Al-Mulali and Ozturk (2015), Bekhet and Othman (2017) & Hossain (2011).

The long-run results of causality show unidirectional causality from urbanization and economic growth to climate change (CO_2). The result explains that urbanization and the growth of an economy are polluting the environment and affecting the climate. The unidirectional causality is also running from urbanization and economic growth to trade and energy. The results also expressed the bidirectional causality between climate change and capital, between energy and climate change, and between trade and climate change (CO_2). The bidirectional association also exits among energy use and climate change.

The results suggest that the migration from rural to urban areas is affecting climate and rising CO_2 emissions. We recommended that the government should adopt the policies to control environmental issues by considering the energy and urbanization policies.

8. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding author.

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