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Environmental Pollution, Terrorism, and Mortality Rate in China, India, Russia, and Türkiye

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Abstract: This paper tests the cointegration and causality between mortality rate, terrorism, economic growth, and environmental pollution in China, India, Russia, and Türkiye in the period from 1990 to 2021 by using the Fourier bootstrapping auto-regressive distributed lag (FBARDL) test and Granger causality with Fourier (FGC) test. The FBARDL test determined cointegration between the selected variables. The FGC test found the evidence of causality among the selected variables. For Russia, Türkiye, India, and China, we found evidence of unidirectional causality running from terrorism to environmental pollution. The evidence of one-way causality from economic growth to environmental pollution was determined for Türkiye and China, but, for India and Russia, we found one-way causality from environmental pollution to economic growth. We found unidirectional causality from terrorism to mortality rate for Türkiye and China. For Russia, we found evidence of none causality. In addition, we determined there was evidence of unidirectional causality from environmental pollution to morality rate.

Keywords: Fourier bootstrapping auto-regressive distributed lag (FBARDL); Granger causality with Fourier; mortality rate; terrorism; economic growth; environmental pollution

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Citation: Bildirici, M.E.; Genç, S.Y.; Castanho, R.A. Environmental Pollution, Terrorism, and Mortality Rate in China, India, Russia, and Türkiye. *Sustainability* **2022**, *14*, 12649. https://doi.org/10.3390/su141912649

Received: 20 August 2022
Accepted: 28 September 2022
Published: 5 October 2022

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1. Introduction

The world is currently dealing with a variety of significant issues, including terrorism and environmental pollution, both of which have a significant effect on sustainable development. Along with terrorist attacks, which are a significant phenomenon facing the world today, environmental degradation as a major issue is increasing.

The literature mainly studies the relationship between terrorism and economic growth. In the literature, it was accepted that by influencing the actions of consumers, producers, and investors, terrorism hinders the economic development and the economic growth of nations and causes a loss of physical and human capital. Moreover, as the number of terrorist attacks increases, political, social, economic, and environmental issues arise.

Globalization has a significant impact on this process since it leads to religious, ethnic, economic, and ideological quarrels. Even while it is not the sole cause of violence or its primary trigger, the globalization process increases terrorism. (For a more in-depth explanation, see [1].) In addition, increasing terrorism causes environmental damages. Because terrorist conflicts, terrorist camps and bases, training exercises, and many more activities of terrorists consume huge amounts of fossil energy [2] and both fossil energy consumption and dangerous heavy metals are released by the weapons of terrorists and terrorists' chemical weapons of mass devastation harm the environment. The effects of metal pollution on ecosystems were demonstrated by [2–5] to be a significant source of pollution. On the other hand, there are numerous indirect effects that remain longer than the direct effects because the environmental effects of chemical emissions and oil usage are long-lasting. Furthermore, these pollutants are affecting the entire world. In addition

to local environmental effects, terrorism causes the adverse impacts of environmental pollution, and leads to some health distortions in the countries of the world.

Environmental quality is declining as a result of these pollutants, which has an impact on human health. These pollutants cause rising mortality rates, acid rain, ozone depletion, and biodiversity loss [6,7]. Particularly in China, poor air quality contributes to serious health issues, including an increase in cancer cases [8]. The World Health Organization estimates that 12.6 million people died as a result of working or living in a hazardous environment in 2012. This rate equates to 23% of all deaths and 26% of deaths among children under the age of five. Terrorist attacks also contribute to various illnesses like cancer, ischemic heart disease, diarrhea, and stroke in the frame of environmental pollution.

This article can be seen as complementing empirical studies in the macroeconomics and energy economics literature. The related literature does not adequately examine the cointegration and causality between terrorism, economic growth, environmental pollution, and mortality rate by using econometric methods. Some papers explored the relation between economic growth and terrorism and some other papers investigated the relation between terrorism and environmental pollution (see the literature section), but these papers did not discuss the relation between terrorism, environmental pollution, and morality rate. To fill this gap, all factors, including economic growth, terrorism, mortality rate, and environmental pollution, were considered in this paper. In this context, this paper investigates cointegration and causality between terrorism, economic growth, environmental pollution, and mortality rate for India, China, Russia, and Türkiye from 1990 to 2021 by the cointegration approach basing on Fourier bootstrapping auto-regressive distributed lag bound method and causality basing on the Fourier VAR method, respectively. The causes for that FBARDL approach to be chosen can be sorted as follows. First, it allows for endogeneity and feedback, and, second, it eliminates degenerate circumstances (see Section 3). Third, in the presence of breaks and if the analysis period is short, the Fourier method provides significant improvement in modeling since the approach does not assume a specific functional form in addition to assuming exact frequencies and in addition to requiring a priori knowledge regarding the dates of the breaks. Lastly, after the FBARDL method is applied, we will apply the Fourier VAR method with ECM. The Fourier VAR method will allow us to determine the direction of causality between the variables.

This paper is organized as follows. The second part provides a literature review. The econometric methodology is given in the third part. Data are explained in the fourth part. In the fifth section, the empirical results are presented. The discussion is presented in the sixth part, and the conclusion is provided in the final part.

2. Literature

Grossman and Krueger [7] employed the environmental Kuznets curve (EKC) approach to assess the relationship between economic growth and environmental damage, and they discovered that there were adverse effects of economic growth on the environment. Following [7], who found that, if a certain level of GDP per capita is reached, economic development tends to aggravate environmental pollution problems, some articles examined the relationship between environmental pollution and industrial production. Numerous papers repeatedly focused on these relationships between different countries. The relation between environmental pollution and real GDP is established by [8] for China, [9] for India, and [10] for China and India. Other studies that look into the connection between environmental pollution and economic growth, including [11,12], etc. Ref. [13] investigate the relationship between EKC and several types of environmental polluters for 36 developing and developed countries and suggest that EKC is not valid for models that include nitrous oxide (N_2O) and CO_2 emissions. According to [14], who researched the nonlinear effects of CO_2 emissions on GDP for 13 industrialized nations between 1870 and 2011, economic expansion had a positive impact on emissions in both time periods. Using the LSTARDL model in the USA, [15] studied the EKC hypothesis under several regimes. Jena et al. [16] explored the existence of the EKC hypothesis in Asia's top emitters. Mujtaba [17] tested the

energy consumption on environmental pollution. Zeeshan et al. [18] studied environmental pollution and household health expenditure from 1990 to 2019 in China. Zeeshan et al. [19] explored the environmental quality in developed countries from 2001 to 2018.

In the context of terrorism, Enders and Sandler [20] used a VAR model to examine the relationship between tourism and terrorism in Spain from 1970 to 1999. Enders et al. [21] examined the correlation between travel and terrorism in Spain, Austria, and Italy between 1974 and 1988. Some of the publications proceeded by researching how terrorism affects macroeconomic factors. Enders and Sandler [22] calculated the losses in net foreign direct investment (FDI) resulting from terrorism between 1968 and 1991 for Greece and Spain. According to [23], terrorism has an impact on a nation's development. When [24] tested the impacts of terrorist attacks for 177 countries between 1968 and 2000, they found that these assaults have a detrimental impact on economic growth. Terrorism has been shown by [25] to have a detrimental impact on a nation's economic performance. Gaibulloev and Sandler [26] explored the relationship between economic growth and terrorism in Asia from 1970 to 2004. Gries et al. [27] concluded that terrorism had a negative influence on economic growth for seven Western countries between 1950 and 2004 because terrorist actions have an effect on resource allocation and accumulation. By using the Panel cointegration tests and Granger causality tests, [2] studied the relationship between economic growth, foreign direct investments (FDI), terrorism, energy consumption, and environmental pollution for Thailand, Yemen, Iraq, Syria, Somalia, Nigeria, Pakistan, Afghanistan, and the Philippines covering the period from 1975 to 2017. The causality results show that there is evidence of a unidirectional causality relationship between carbon dioxide (CO_2) emissions and terrorism. For Israel, Türkiye, India, and China from 1975 to 2017, [28] examined the cointegration between environmental degradation, terrorism, FDI inflow, economic growth, and energy consumption. The findings of the causality tests indicate a unidirectional causality from terrorism, energy usage, and FDI to environmental pollution.

3. Econometric Methodology

The FBARDL approach was applied in this study. On cointegration tests, some articles use the bootstrapping method, including [29–32]. Swensen [32] demonstrated the significance of using bootstrap method for the Johansen cointegration test, and some of the theoretical elements for bootstrapping cointegration were established by [33].

Degenerate cases for the ARDL method were demonstrated by [34,35]. The BARDL bound test was designed by [34,35] as an addition to the tests for cointegration suggested by [36]. This method allows for the differentiation between non-cointegration, cointegration, and degenerate cases for the ARDL method suggested by [36]. As mentioned in the introduction section, the Fourier BARDL method allows the elimination of gradual breaks since, as accented by [37], the Fourier method does not require to know the exact frequency of breaks and break dates. So the FBARDL method diminishes the need for many parameters.

Fourier Bootstrapping ARDL Method

In an error-correction representation, the FBARDL bound approach is given as follows [38,39]:

$$\Delta A_t = c_0 + \sum_{i=1}^{m-1} \gamma_i \Delta A_{t-i} + \sum_{j=1}^{m-1} \phi_j \Delta B_{t-j} + \delta_1 A_{t-1} + \delta_2 B_{t-1} + \gamma_{10} \sin\left(\frac{2\pi nt}{T}\right) + \gamma_{11} \cos\left(\frac{2\pi nt}{T}\right) + \varepsilon_t \quad (1)$$

where ε_t is i.i.d and:

$$\sigma^2 \, \varepsilon(0, \infty) \quad (2)$$

B_t is the explanatory variables. Where

$$\delta_1 = -(1 - \sum_{i=1}^{p} \alpha_i); \delta_2 = \sum_{j=1}^{q} \beta_j) \quad (3)$$

γ_i ϕ_j and λ_k are functions of the original parameters.

By assuming that the dependent variable must be I(1), [36] eliminates degenerate case-1 (1). To ascertain the presence of any non-cointegration, cointegration, or degenerate cases, their method requires the use of three tests.

McNown et al. [34] showed that the cointegration between A and B requires the rejection of three null hypotheses.

Case-1: F test for $H_0 : \delta_1 = \delta_2 = 0$ against. H_1 : any $\delta_1, \delta_2 \neq 0$

Case-2 t test for $H_0 : \delta_1 = 0$ against

$$H_1 : \beta_1 \neq 0 \tag{4}$$

Case-3 F test for $H_0 : \delta_2 = 0$ against. $H_1 : \delta_2 \neq 0$

Causality Test

The Fourier method was applied to test the evidence of Granger causality. If the evidence of cointegration is determined between the selected variables, the Fourier VAR test with ECM will be applied.

The model is rewritten for Granger causality

:

$$\Delta y_t = c_0 + \sum_{i=1}^{p} \alpha_1 \Delta y_{t-i} + \sum_{n=1}^{q} \beta_1 \Delta x_{t-n} + \gamma_{10} \sin\left(\frac{2\pi nt}{T}\right) + \gamma_{11} \cos\left(\frac{2\pi nt}{T}\right) + \zeta_1 ecm_{t-1} + \varepsilon_{1t} \tag{5}$$

$$\Delta x_t = c_{02} + \sum_{i=1}^{k} \alpha_2 \Delta x_{t-i} + \sum_{n=1}^{m} \beta_2 \Delta y_{t-n} + \gamma_{20} \sin\left(\frac{2\pi nt}{T}\right) + \gamma_{21} \cos\left(\frac{2\pi nt}{T}\right) + \zeta_2 ecm_{t-1} + \varepsilon_{2t} \tag{6}$$

In Equations (5) and (6), where ε_t is i.i.d and σ^2 $\varepsilon(0, \infty)$; and ζ is the parameter defining the speed of adjustment to the long-run equilibrium after a shock. The error correction mechanism to occur, ζ should be statistically significant and non-positive in the range of $-1 < \zeta < 0$. The short-run Granger non-causalities are tested under the null hypotheses of $H_0 : \alpha_1 = 0$, $H_0 : \beta_1 = 0$, against the alternatives $H_1 : \alpha_1 \neq 0$, $H_1 : \beta_1 \neq 0$ in Equations (5) and (6).

4. Data

From 1990 to 2021, annual data on mortality rate (d), environmental pollution (c), and economic growth were gathered from the World Bank (WB). Economic growth is measured by real GDP in US dollars. Environmental pollution was measured by CO_2 emissions. Data on terrorism (t) were gathered from GTI and RAND, which is a variable that includes the number of people dead from attacks (see Table 1). To minimize skewness, the variables were logged (ln), and so they were measured in logarithms.

The selected countries are not the countries that suffer the highest number of terrorist attacks in the world, but these countries have high rates in the G20 countries. Moreover, these countries have the worst environmental index in the G20 countries. Table 1 displays the GTI and EPI indexes.

To determine if the variables are I (1), a two unit root test was employed. In the context of confirmatory analysis, the KPSS test was utilized for confirmatory analysis to cross-check the results of the ADF test. All variables were found to be I (1) by the ADF test in Table 2.

Table 1. Variable Description, GTI * index and EPI index **.

Variable Description				
Variable:	Description:			Source:
Economic growth (y)	Real GDP in US dollars			World Bank (WB)
Environmental pollution (c)	CO_2 emissions (kt)			World Bank (WB)
Terrorism (t)	Number of people dead by terrorist attacks			GTI and RAND
Mortality rate (d)	Mortality rate, adult, female and male (per 1000 female and male adults)			World Bank (WB)
GTI Index				
Rank	**Countries**	**2021 Score**	**Change 2011–2021**	**Change 2020–2021**
12	India	7.432	−0.691	−0.235
44	Russia	4.219	−3.328	−0.465
67	China	1.863	−3.245	−0.704
23	Türkiye	5.651	−1.261	−0.820
EPI Index				
Rank	**Countries**	**2022 Score**	**10-year Change**	
180	India	18.90	−0.6	
112	Russia	37.50	1.6	
160	China	28.4	11.4	
172	Türkiye	26.3	−0.5	

* https://reliefweb.int/report/world/global-terrorism-index-2021 (accessed on 07 July 2022). ** https://epi.yale.edu/epi-results/2022/component/epi (accessed on 07 July 2022).

Table 2. Descriptive Statistics and Unit Root Tests.

Descriptive Statistics								
	China				**India**			
	c	d	t	y	c	d	t	y
Maximum	3.269	3.07	0.41	6.83	3.783	4.296	0.580	3.194
Skewness	−0.32	−0.98	−0.55	0.68	0.311	0.177	0.330	0.0277
Kurtosis	1.624	3.06	1.77	1.07	1.779	1.626	1.613	1.674
	Türkiye				**Russian Federation**			
	c	d	t	y	c	d	t	y
Maximum	2.214	4.296	0.580	3.60	2.214	3.246	3.406	3.117
Skewness	0.696	0.177	0.330	2.20	1.696	1.97	0.586	0.308
Kurtosis	2.590	1.626	1.613	2.58	2.590	1.33	1.787	1.215
Unit Root Test								
	China		**India**		**Türkiye**		**Russian Federation**	
	ADF	KPSS	ADF	KPSS	ADF	KPSS	ADF	KPSS
t	−0.898	0.976	−1.27	0.981	−1.760	0.971	−1.684	0.803
dt	−5.962	0.036	−4.76	0.142	−7.664	0.207	−6.804	0.173
Y	−1.15	0.986	0.335	0.894	−0.171	0.976	−1.605	0.969
dY	−8.065	0.016	−3.285	0.057	−5.624	0.223	−8.963	0.185
c	−1.184	0.978	−0.393	0.838	−0.688	0.870	−1.225	0.858
dc	−5.088	0.074	−7.002	0.123	−5.892	0.113	−5.508	0.162
d	−1.004	0.883	−1.298	0.994	−1.390	0.944	−1.674	0.909
dd	−4.996	0.055	−5.091	0.099	−5.863	0.105	−8.697	0.031

5. Empirical Results

In Table 3, the results found by the FBARDL model are presented.

Table 3. Fourier Bootstrapping ARDL.

Country	Dependent Variable/Independent Variable	F	F *	Findep	F * Indep	t	T *	Cointegration Status
India	(y/d, c, t)	18.28	15.8	15.563	14.576	−5.19	−3.01	Cointegration
	(d/c, t, y)	1.87	2.25	3.4	3.63	−0.99	0.99	No-Cointegration
	(c/t, y, d)	9.56	3.93	2.48	3.99	−3.01	−3.53	Degenerate 1
	(t/y, d, c)	3.15	4.29	0.71	5.042	−0.81	−4.12	No-Cointegration
China	(y/d, c, t)	3.335	4.41	4.85	4.98	−3.1	−1.023	No-Cointegration
	(d/c, t, y)	1.23	3.05	1.56	4.12	−1.78	−2.98	No-Cointegration
	(c/t, y, d)	7.652	7.00	8.96	7.01	−4.1	−3.89	Cointegration
	(t/y, d, c)	5.45	4.03	2.05	6.89	−2.92	−2.89	Degenerate 1
Türkiye	(y/d, c, t)	7.17	6.03	7.96	6.63	−3.83	−3.36	Cointegration
	(d/c, t, y)	11.23	4.46	1.89	5.16	−2.96	−2.89	Degenerate 1
	(c/t, y, d)	8.56	7.1	2.83	3.63	−2.19	−2.18	Degenerate 1
	(t/y, d, c)	1.66	1.81	1.92	2.02	−0.71	−0.89	No-Cointegration
Russia	(y/d, co, t)	13.63	12.8	13.5	11.56	−4.26	−3.81	Cointegration
	(d/co, t, y)	8.12	7.21	2.36	5.12	−2.12	−3.09	Degenerate 1
	(c/t, y, d)	1.96	2.36	3.01	3.96	−0.89	−0.93	No-Cointegration
	(t/y, d, c)	1.73	1.81	1.11	1.26	−1.01	−1.21	No-Cointegration

Note: * test's names

If economic growth was recognized as the dependent variable, the evidence of cointegration was found for Türkiye, Russia, and India, but no-cointegration for China. When terrorism was recognized as the dependent variable, there is evidence of no-cointegration between terrorism, mortality rate, environmental pollution, and economic growth in Türkiye, Russia, and India. For China, degenerate case 1 has been obtained to be valid. The evidence of cointegration was found for China, degenerate 1 for India and Türkiye, and no-cointegration for Russia if environmental pollution is accepted as the dependent variable.

In Table 4, long-run and ECM coefficients were given. In the results of a long run, the signs of the coefficients of terrorism in India, Türkiye, and Russia are positive. This paper determined the positive impacts of terrorist attacks on economic growth for India, Türkiye, and Russia. Study [24] for 177 countries found different results, [40,41] for developed and developing countries, and [27] for seven Western countries. For China, the effect of terrorism on environmental pollution is positive and statistically significant.

Table 4. Long-run coefficients and ECM.

	India (Dependent Variable: y)	China (Dependent Variable: c)	Türkiye (Dependent Variable: y)	Russia (Dependent Variable: y)
ly	-	0.48 (2.36)	-	-
lt	0.115 (1.98)	0.31 (1.85)	0.18 (1.91)	0.193 (1.94)
ld	0.226 (2.02)	0.11 (2.03)	0.19 (2.14)	0.32 (2.45)
lc	0.31 (1.83)	-	0.046 (1.99)	0.0027 (1.88)
ecm	−0.38 (1.92)	−0.41 (2.18)	−0.36 (1.96)	−0.43 (1.88)
F1	0.00012 (1.76)	0.0003 (1.93)	−0.0002 (2.46)	−0.009 (2.42)
F2	−0.00007 (1.88)	0.00006 (1.81)	0.00001 (2.35)	0.0007 (2.55)
R^2	0.79	0.72	0.79	0.71

6. Causality Results

Table 5 exhibits the direction of causality between the variables.

Table 5. Causality Results.

Direction of Causality					
$\Delta ly \rightarrow \Delta lt$ $\Delta lt \rightarrow \Delta ly$	$\Delta ly \rightarrow \Delta lc$ $\Delta lc \rightarrow \Delta ly$	$\Delta ly \rightarrow \Delta ld$ $\Delta ld \rightarrow \Delta ly$	$\Delta ld \rightarrow \Delta lc$ $\Delta lc \rightarrow \Delta ld$	$\Delta lc \rightarrow \Delta lt$ $\Delta lt \rightarrow \Delta lc$	$\Delta lt \rightarrow \Delta ld$ $\Delta ld \rightarrow \Delta lt$
India					
0.78 (0.0152) 8.766 (0.019) Unidirectional $T \rightarrow Y$	0.66 (0.718) 8.321 (0.015) Unidirectional $C \rightarrow Y$	7.0258 (0.089) 0.11 (0.95) Unidirectional $Y \rightarrow D$	1.589 (0.451) 9.85 (0.007) Unidirectional $C \rightarrow D$	1.247 (0.535) 8.494 (0.01) Unidirectional $T \rightarrow C$	7.08 (0.96) 0.089 (0.01) Unidirectional $T \rightarrow D$
China					
1.21 (0.07) 0.112 (0.07) *None*	11.72 (0.001) 0.77 (0.71) Unidirectional $Y \rightarrow C$	9.98 (0.008) 0.18 (0.92) Unidirectional $Y \rightarrow D$	0.43 (0.07) 5.89 (0.65) Unidirectional $C \rightarrow D$	0.95 (0.03) 7.203 (0.02) Unidirectional $T \rightarrow C$	6.78 (0.07) 7.71 (0.02) Bidirectional
Türkiye					
0.734 (0.007) 9.76 (0.01) Unidirectional $T \rightarrow Y$	8.483 (0.803) 1.250 (0.54) $Y \rightarrow C$	0.904 (0.64) 1.19 (0.55) None	0.98 (0.612) 7.388 (0.019) Unidirectional $C \rightarrow D$	1.470 (0.489) 6.338 (0.01) Unidirectional $T \rightarrow C$	9.71 (0.75) 0.50 (0.08) Unidirectional $T \rightarrow D$
Russia					
1.87 (0.013) 7.12 (0.58) Unidirectional $T \rightarrow Y$	0.38 (0.015) 7.02 (0.619) Unidirectional $C \rightarrow Y$	0.38 (0.79) 0.61 (0.78) None	0.89 (0.002) 0.27 (0.07) None	0.151 (0.93) 5.46 (0.07) Unidirectional $T \rightarrow C$	0.47 (0.12) 0.187 (0.92) None

The results of causality can be given as follows:

1. The evidence of one-way causality from economic growth to environmental pollution was determined for Türkiye and China, but, for India and Russia, the evidence of one-way causality was found from environmental pollution to economic growth.
2. The results indicate the causality between terrorism and environmental pollution. Hence, for Russia, Türkiye, India, and China, the evidence of unidirectional causality was found from terrorism to environmental pollution. The result of the unidirectional causality from terrorism to CO_2 emissions is similar to [2,28].
3. None causality between terrorism and mortality rate was determined for Russia. In India and Türkiye, the evidence of one-way causality from terrorism to mortality rate was determined, as was bi-directional causality for China.
4. Except in China, the evidence of unidirectional causality was found from T to Y. For China, the evidence for none causality was found.
5. Except in Russia, the evidence of unidirectional causality was found from environmental pollution to mortality rate. The results of causality between mortality and environmental pollution were similar to the results of [42,43].
6. Unidirectional causality was found from economic growth to morality for India and China, and the evidence of none causality was found for Türkiye and Russia.

7. Discussion

The environmental pollution cost of economic growth, and health costs and environmental pollution of terrorism are the most important problems in the world. Our results indicate the evidence of unidirectional causality running from economic growth to environmental pollution for Türkiye and China. This is a conclusion highlighted by many articles in the context of the EKC hypothesis. Additionally, there is a unidirectional causality from environmental pollution to economic growth for India and Russia as a different result from the EKC hypothesis. The findings of unidirectional causality running from terrorism to environmental pollution were determined for selected countries. For all

countries, terrorism is the cause of environmental pollution. This result is similar to the results of [2,26]. Accordingly, in the results of unidirectional causality from environmental pollution to mortality rate, environmental pollution is the Granger cause of mortality in the selected countries. Granger causality determined causality between terrorism and mortality in all selected countries except Russia. Terrorism is the Granger cause of environmental pollution and mortality.

The mortality rate from ambient air pollution in 2016 is shown in Figure 1. The rates for China and India are extremely high.

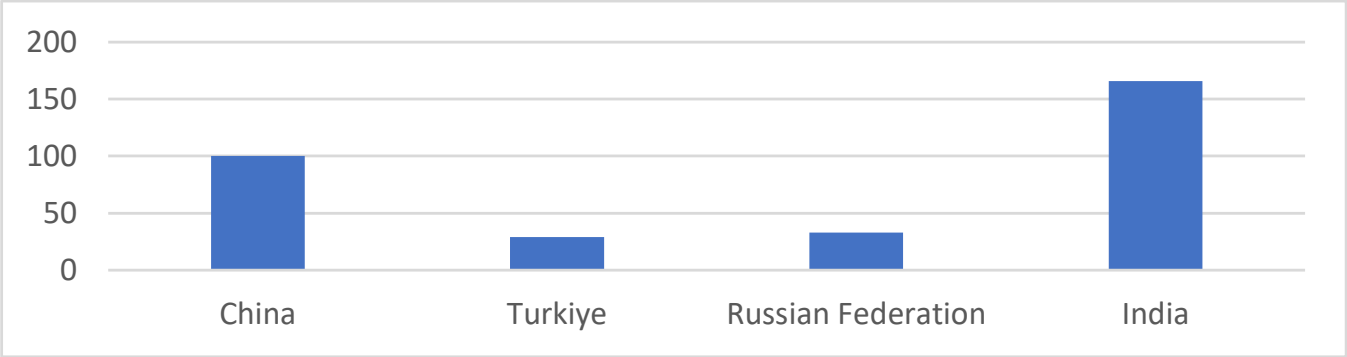


Figure 1. Mortality rate attributed to household and ambient air pollution, age-standardized (per 100,000 population) for 2016.

Environmental pollution is also a root cause of other health problems (for similar emphasis on these countries, see [7,40]). Figure 2 displays the mortality rate that is due to CVD, diabetes, and cancer. India has the highest rate among the selected countries.

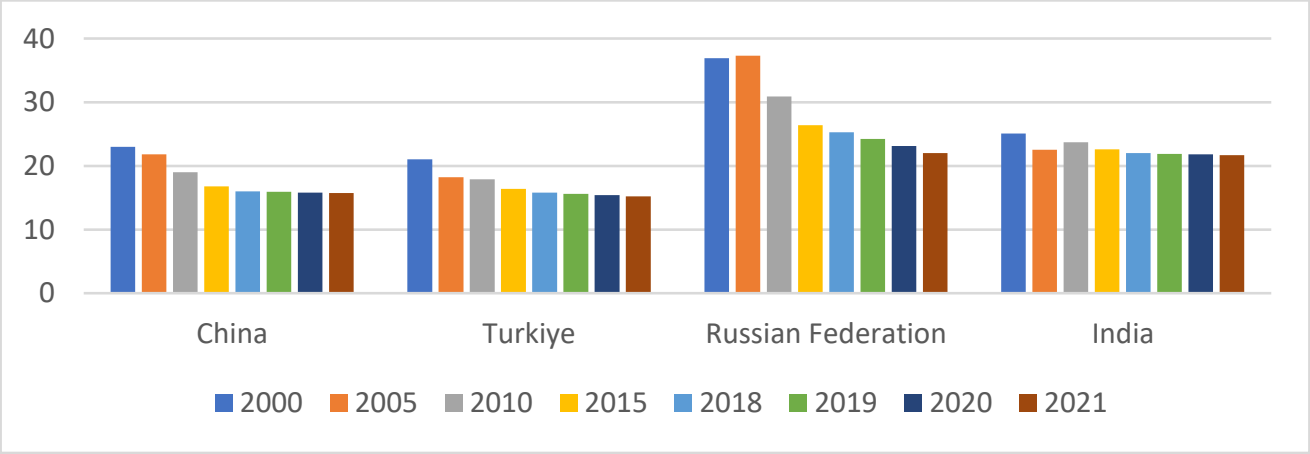


Figure 2. Mortality from CVD, cancer, diabetes, or CRD between the exact ages of 30 and 70 (%).

In these countries, the life expectancy at birth is also low if compared to in developed countries and some G20 countries, and especially G7 countries. Indeed, this rate is lower than in other G7 nations, such as Japan (84.17585), Italy (82.5439), and France (82.27317), when comparing life expectancy at birth in these nations. The life expectancy at birth in various nations is shown in Figure 3.

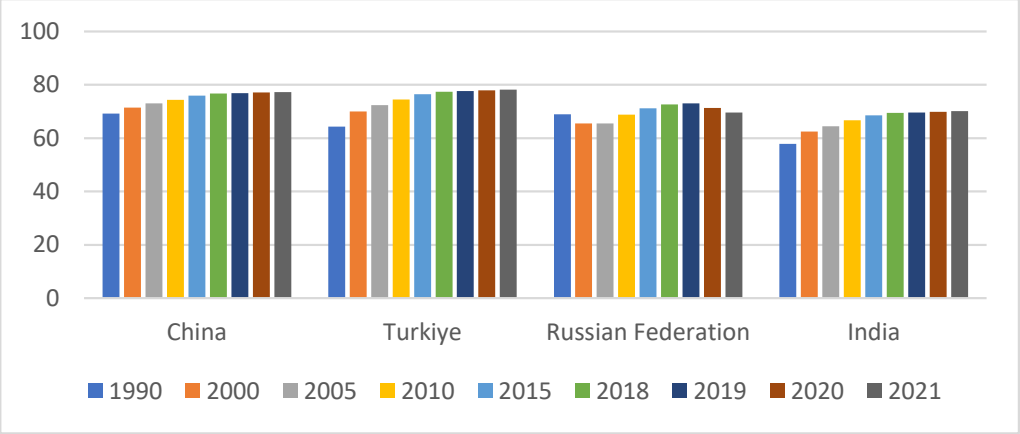


Figure 3. Life expectancy at birth.

We found the effects of the environment and terrorism on the mortality rate. The reason for the negative effects of terrorism on the environment is that terrorists' weapons, bombings, or the other activities are harmful factors. Moreover, terrorists use fossil energy in their camps and during their activities, causing a negative impact on the environment. Moreover, the effects of environmental pollution on health are a problem for the whole world. As an effect of these results, policymakers should set policies to prevent terrorism and environmental pollution. Terrorism and environmental pollution are important problems for the whole world. To prevent these, international cooperation should be established.

8. Conclusions

In this paper, we determined the cointegration and causality among environmental pollution, terrorism, mortality rate, and economic growth for China, India, Russia, and Türkiye by using Fourier bootstrapping ARDL and Granger causality tests with Fourier from 1990 to 2021.

According to the causality results, terrorism has an important impact on environmental pollution in China, India, Russia, and Türkiye. More importantly, the mortality rates in China, India, and Türkiye are significantly affected by environmental pollution.

Terrorism consumes a tremendous amount of energy, which adds to the accumulation of CO_2 emissions in the environment. Additionally, the use of high-tech equipment is increasing the energy demand of terrorism on a regular basis.

In terms of environmental damage, the findings of this study identified three key findings. First and foremost, policymakers need to fight hard to lessen environmental harm. In this perspective, economic growth and energy consumption must be compatible with the aim of achieving enhancements in environmental quality. One of the major contributors to CO_2 emissions is the concentration of high-emission sectors in these nations. The lack of environmental legislation and the low level of awareness for polluting sectors are major factors in the accumulation of emissions in these nations. Hence, governments need to pay closer attention to programs aimed at reducing pollution, as well as the effects of terrorism inflows on environmental indicators. Second, when governments become more responsive, CO_2 emissions might be reduced. It is necessary to use renewable energy sources to lessen environmental damage. Finally, joint action must be taken to reduce terrorism, which is a mutual problem for the whole world.

It is expected that this work will be a guide for future studies. We hope that different studies will test this issue for different countries.

Author Contributions: Conceptualization, M.E.B.; methodology, M.E.B. and S.Y.G.; software, M.B; validation, M.E.B., S.Y.G. and R.A.C.; formal analysis, M.E.B. and S.Y.G.; investigation, M.E.B., S.Y.G. and R.A.C.; resources, M.E.B. and S.Y.G.; data curation, M.E.B., S.Y.G. and R.A.C.; writing—original draft preparation, M.B; writing—review and editing, M.E.B. and S.Y.G.; visualization, M.E.B., S.Y.G.

and R.A.C.; supervision, M.E.B. and S.Y.G.; project administration, M.E.B., S.Y.G. and R.A.C.; funding acquisition, R.A.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Mortality rate, environmental pollution, and economic growth were gathered from the World Bank (WB). Data on terrorism (t) were gathered from GTD and RAND.

Conflicts of Interest: The authors declare no conflict of interest.

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