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Research Article/Araştırma Makalesi

Does Globalization Increase Environmental Pollution? Evidence from Turkey

Küreselleşme Çevre Kirliliğini Artırıyor mu? Türkiye'den Kanıtlar

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Abstract

The effects of globalization and economic growth on environmental pollution are still a matter of debate among researchers. In the study, Turkey, which has developed its economic cooperations and trade relations with other countries and become globalized after World War II, which defined export-oriented growth as its target, and which has a carbon-dense economy, is being handled. In the study, the effects of the variables of globalization, primary energy consumption, trade openness, urbanization and economic growth on environmental pollution (CO2) are tested econometrically, by using annual data of Turkey between 1970-2020. During testing the relations between variables, ARDL method has been used. According to the results, both short-run and long-run relations have been observed between variables, and coefficients have been found statistically significant. It is resulted in the model that independent variables of energy consumption, urbanization and economic growth increase the dependent variable-environmental pollution. Toda- Yamamoto causality test has been applied which is preferred at most in situations that ARDL method is practiced. According to the causality test results, between trade openness, pollution, and globalization two-way causality relationship is discovered whereas from environmental pollution towards economic growth and urbanization, from energy consumption and trade openness towards urbanization, from economic growth towards trade openness one-way causality relationship is observed. In this context, suggestions are made to policy makers in order to find solutions and take cautions for environmental pollution which has a great importance both for natural and economic life.

Jel Codes: *F64, O44, F18*
Keywords: *Environmental Pollution, Economic Growth, Globalization*

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Öz

Araştırmacılar arasında, küreselleşmenin ve ekonomik büyümenin çevre kirliliği üzerindeki etkileri, günümüzde hâlâ tartışma konusudur. Bu bakımdan çalışmada, II. Dünya Savaşı'ndan sonra diğer ülkelerle ekonomik iş birliklerini ve ticari ilişkilerini geliştiren, küreselleşmiş, ihracata dayalı ekonomik büyümeyi hedef olarak belirlemiş karbon yoğun bir ekonomiye sahip olan Türkiye ele alınmaktadır. Çalışmada Türkiye'nin 1970 – 2020 yılları arasındaki yıllık verileri kullanılarak; küreselleşme, birincil enerji tüketimi, ticari açıklık, kentleşme ve ekonomik büyüme değişkenlerinin çevre kirliliği (CO_2) üzerindeki etkileri ekonometrik olarak test edilmektedir. Değişkenler arasındaki ilişkilerin test edilmesinde ARDL metodu kullanılmıştır. Ulaşılan sonuçlara göre, değişkenler arasında hem kısa hem de uzun dönemli ilişkiler tespit edilmiş, katsayılar istatistiki olarak anlamlı bulunmuştur. Modelde kullanılan enerji tüketimi, kentleşme, küreselleşme ve ekonomik büyüme bağımsız değişkenlerinin bağımlı değişken olan çevre kirliliğini artırdığı sonucuna ulaşılmıştır. Ticari açıklık değişkeni ise istatistiki olarak anlamsız bulunmuştur. ARDL metodunun uygulandığı durumlarda en çok tercih edilen Toda – Yamamoto nedensellik testi uygulanmıştır. Nedensellik test sonuçlarına göre, ticari açıklık ve çevre kirliliği ile küreselleşme arasında çift yönlü, çevre kirliliğinden ekonomik büyüme ve kentleşmeye, enerji tüketimi ve ticari açıklıktan kentleşmeye, ekonomik büyümeden ticari açıklığa doğru tek yönlü nedensellik ilişkisi olduğu ortaya koyulmuştur. Bu bağlamda gerek doğal gerekse ekonomik yaşam açısından ciddi öneme sahip çevre kirliliğinin çözümü ve gerekli önlemlerin alınması için politika yapıcılarına önerilerde bulunulmuştur.

Jel Kodları: *F64, O44, F18*
Anahtar Kelimeler: *Çevre Kirliliği, Ekonomik Büyüme, Küreselleşme*

1. Introduction

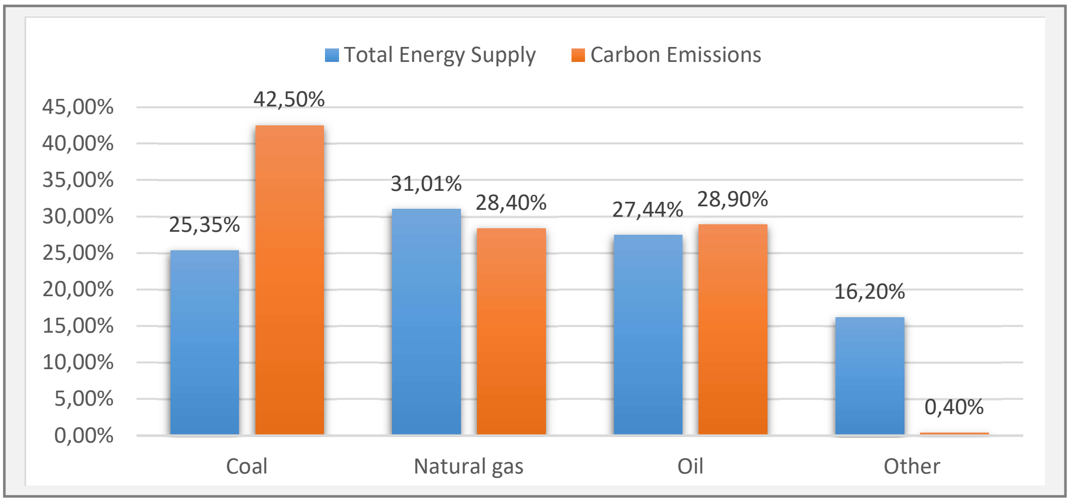
Globalization, known as the period in which ideas, information, goods, and services spread to the world, has caused international trade volume to be increased and transnational capital movements to be condensed. This period has also changed political dynamics of the world, and helped once fighting countries to be friends then, or at least to make collaboration in trade. The development of international trade cooperation leads to global climate changes depending on the growth of economies and the increase in energy consumption. In this regard, environmental results of globalization, in other words, how it affects the environment has attracted researchers' interest. In the studies that researchers deal with, globalization indexes that Swiss Economic Institute (KOF SEI) has published are used as the indicator of globalization. KOF SEI index is the most commonly used among other globalization indexes (2001 Foreign Policy Globalization Index, 2004 Globalization and Regionalization Research Center Index, 2008 Maastrich Globalization Index, 2010 New Globalization Index, and 2012 Human-Based Globalization Index) (Martens et al., 2015: 2). Today, the index includes period between 1970-2020, 215 countries and/or regions. KOF SEI index calculates globalization according to its economic, political and social aspects separately. Index explains actual globalization as "de facto", and globalization resulted from intervention as "de jure".

The interaction between globalization process and environment is theoretically dealt with two different approaches. According to first approach, globalization has three effects on environment- scale, technology and composition effect (Shahbaz et al., 2018: 558-560). Scale effect is explained as, resulting from globalization, ever-increasing trade volume leads to increase in producing the goods that cause pollution, and hence in fossil-based energy consumption, which ultimately cause environmental pollution (Grossman & Krueger, 1991: 3). However, in countries where welfare and income level are high, treating the environment more sensitively can have positive effects (Tutulmaz, 2012: 55). Globalization causes CO_2 emissions to be reduced, as it popularizes the integration of national markets with international markets, producing environmentally friendly goods, using energy-saver technologies. This state is called technological effect (Ertuğrul et al., 2016: 545). Composition effect means, due to globalization, the change of production structure of a country as capital intensive and/or labor intensive. The activities in agriculture, industry and services sectors of a country effect CO_2 emissions. As economic activities move from agriculture sector to industry, CO_2 emission increases, and when it moves from industry sector to services sector it decreases (Haseeb et al., 2018: 31284). The effects of globalization on environment differs according to the dominance of any of these three effects. In developing countries, since scale and composition effect are predominant over technological effect, globalization is likely to pollute the environment. On the contrary, in developed countries, as technological effect is predominant over scale and composition effects, globalization is likely to have a diminishing effect on environmental pollution (Jun et al., 2020: 1186).

According to the second approach, interaction between globalization process and environment is explained on the basis of pollution havens hypothesis. The hypothesis makes a connection between the strictness of environmental regulations in a country, trade level and pollution. According to the hypothesis, the corporations that operate in developed countries where regulations are stricter, and that pollute the environment, assert that they will transfer their operations to the countries where environmental regulations are weaker, and thus they will continue to pollute the environment. With globalization, the fact that drawbacks in production factors have been reduced, and improvements in technology cause multinational corporations (MNC) transfer their productions into developing countries where environmental regulations are fewer and labor cost is lower (Solarin, et al., 2017: 706). Since MNCs operate in sectors such as automobile, petrol, chemistry, rubber which increase environmental pollution significantly, they also cause a considerable increase in pollution in the countries they have gone (Aykiri & Bulut, 2019: 71-72). Environmental pollution that occurs as a result of globalization affects not only one country but the whole world in the course of time. In order to prevent pollution, solutions need to be developed, not only on national basis but also on global scale.

Environmental pollution is increasing day by day due to the intensive energy use. Energy sources are divided into two, as to their usage, being renewable and non-renewable energy sources. Renewable energy sources are classified as hydraulics, wind, solar, geothermal, biomass, tides, hydrogen and wave energy. Non-renewable energy sources comprise of fossil-based (coal, petrol, natural gas), and core-driven (uranium, thorium) sources. In Figure 1, related data is seen about Turkey's total energy supply and CO_2 emission in 2021.

Figure 1: Rates of Fuels in Turkey's Energy Supply ve CO_2 Emissions (2021, %)



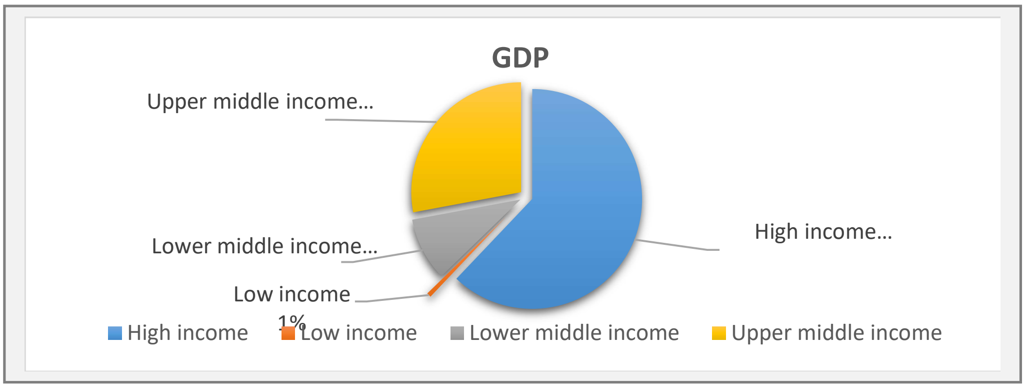
Source: Preapered by using IEA database.

According to the data in Figure 1, although Coal represents 30% of Turkey's total energy supply in 2021, it causes 43% of CO2 emission due to the heavy carbon content per energy released. When compared to natural gas, it is understood that the emission density of coal is twice as much. Common use of coal in power generation and heating causes CO2 release rates to rise, and hence increases environmental pollution. Other energy sources consist of nuclear, hydro, geothermal, solar, wind, biomass and waste. Whereas the share of other energy sources in total energy supply is 16 %, heavy carbon content per energy released is too below 1%. The energy sources necessary for Turkey's economic growth are mostly based on fossil fuels-which pollute the environment and cause climate changes.

Economic growth is one of the main factors that affect environmental pollution. Countries, in the beginning phase of economic growth process, have insufficient information about pollution created by this process, and do not have the advanced technologies to prevent pollution (Dinda, 2004: 434). Therefore, as the production amount increases, the depletion speed of natural sources will outpace renewal speed of sources, and this will ultimately increase environmental pollution. At this stage countries tend to prefer to grow by ignoring pollution. As countries continue growing, and income and welfare level increases, they develop policies aimed at preventing environmental pollution, and take measures to reduce CO_2 emissions (Albayrak & Gokce, 2015: 286-287). In this respect, economic growth can leave its growing form as polluting the environment and transform into an eco-friendly growing form.

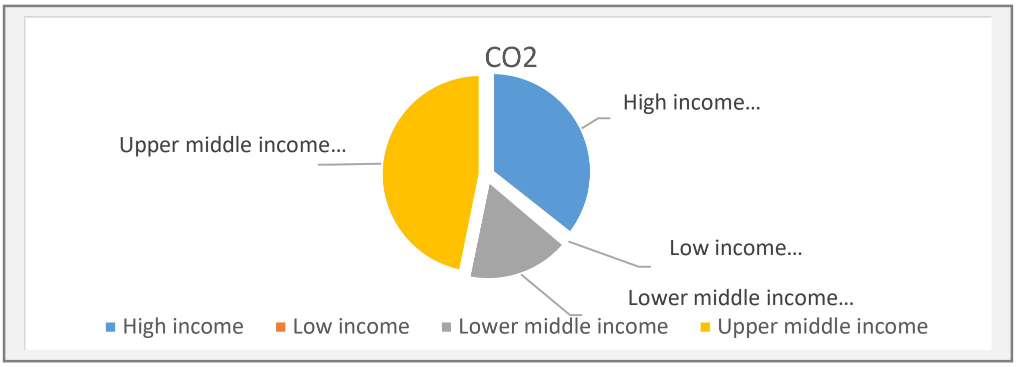
While in 1980 world economy produced nearly worth 26.3 trillion dollars (fixed 2015 USA dollar), with economic and technological developments, in 2021 it became to be able to produce nearly 86.8 trillion (fixed 2015 USA dollar). In this 41-year period, world production increased almost 3.3 times as much. In the same period, total CO_2 emissions increased from 20.9 billion metric ton to 38.58 billion metric ton with a nearly 84.6 % rise. According to data of the year 2019 in Figure 2, the share of countries with higher income in total GDP (Gross Domestic Product) is about 62 %. The share of countries with upper-middle income in GDP in 2019 is around 28 %. The share of lower-middle income and lower income countries in world economy is respectively 9 % and 1 %.

Figure 2: The Share of Various Countries Groups in Total GDP in 2019



Source: Prepared by using WDI database.

Figure 3: The Share of Various Countries Groups in Total CO_2 in 2019

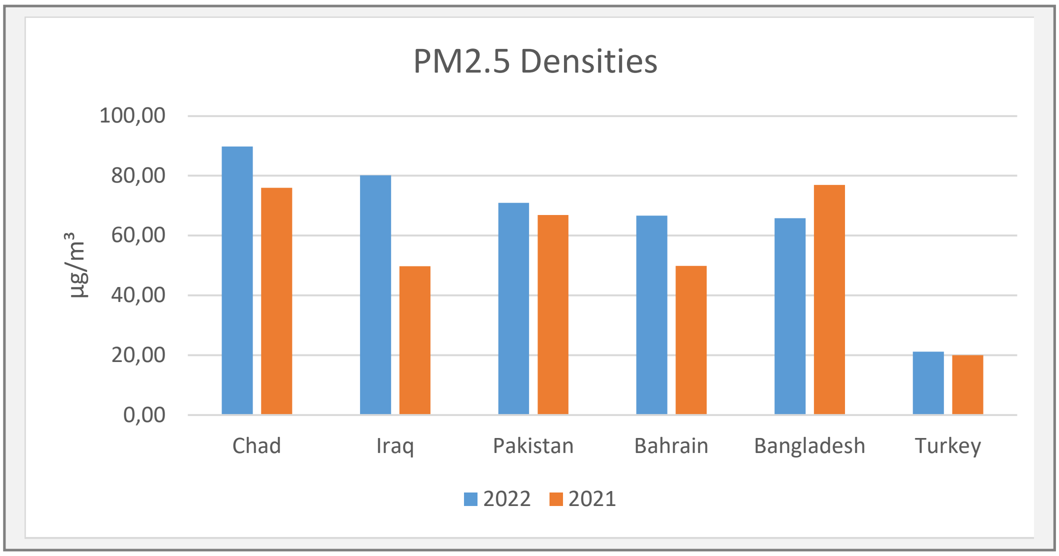


Source: Prepared by using WDI database.

In Figure 3, the shares of groups of countries that belong to different development levels in total carbon dioxide emission in 2019. It is seen that countries with higher income which makes production worth two out of three in total GDP, own nearly a 36% share in CO_2 emissions. Countries with upper-middle income that are ranked in the second place in world economy are responsible for 47% of total carbon dioxide emission in 2019. The fact that upper-middle income countries have the higher share can be linked to their focus on merely economic growth targets and ignore the environmental pressures. High income countries having a bigger share in GDP can also be related to the fact that they make technological productions with higher added value. The share of lower-middle income countries in CO_2 emission in 2019 is about 17%, and lastly lower income countries have almost 0% share.

World Air Quality Report prepared every year by IQAir technology company centered in Switzerland demonstrates air quality and pollution of countries. In the annual reports, on global scale fine particulate matter (PM2.5) density measurements are analyzed. PM2.5 emissions consist of elements such as fossil-fired motor vehicles, energy generation, industrial activities, agriculture and biomass firing. According to the World Air Pollution Report in which PM2.5 densities of 131 countries are being analyzed, PM2.5 particle densities ranged between 89.7 μg/m³ and 1.3 μg/m³ in 131 countries. The values mentioned are between 76.9 μg/m³ and 3,8 μg/m³ in 117 countries in 2021. Figure 4 shows 5 countries where PM2.5 densities are at highest level in the world in 2022, and to make a comparison, Turkey as ranked the 45th.

Figure 4: 5 Countries with Highest PM2.5 Densities and Turkey

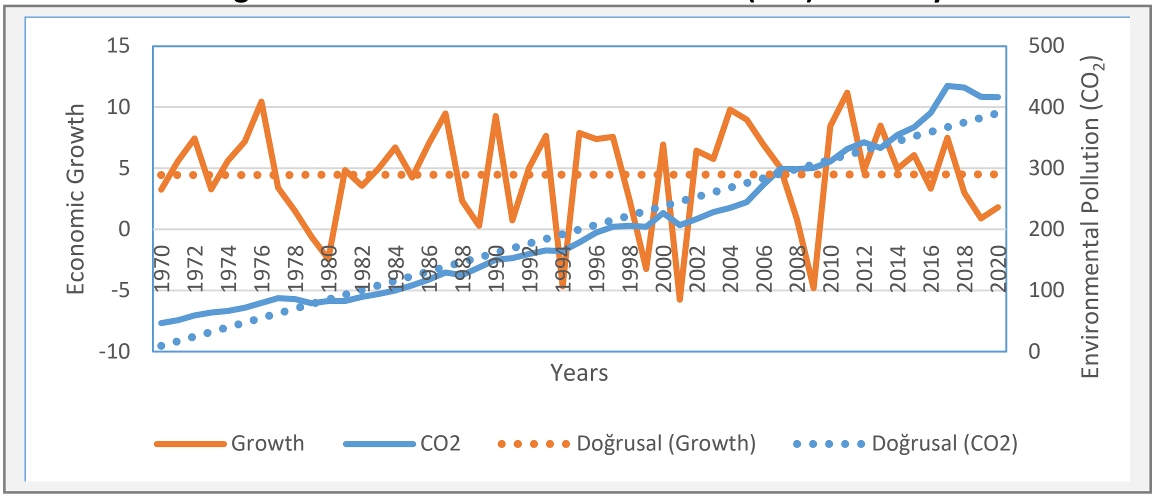


Source: Prepared by using iqair database. (www.iqair.com Erişim Tarihi: 23.03.2023)

When the data in Figure 4 is evaluated, it is observed that the countries with the highest PM2.5 densities in the world are respectively Chad, Iraq, Pakistan, Bahrain and Bangladesh. While Turkey, among 131 countries, is ranked as number 45 with 21,1 μg/m³ in 2022, it is the 46th with 20,0 μg/m³ among 117 countries in 2021.

Although it showed a decline in some certain years, Turkish economy, being in upper-middle income group, achieved 4,5 % growth in average annually between 1970-2020. This situation can be explained as the growth of Turkish economy depends on industrialism, as a developing country, and industrialism increases environmental pollution (CO_2 emissions) due to consumption of petrol and fossil fuels. In Figure 5, the relationship between Turkey's economic growth in 1970-2020 and CO_2 emissions (environmental pollution) is shown.

Figure 5: National Income and Pollution (CO_2) in Turkey

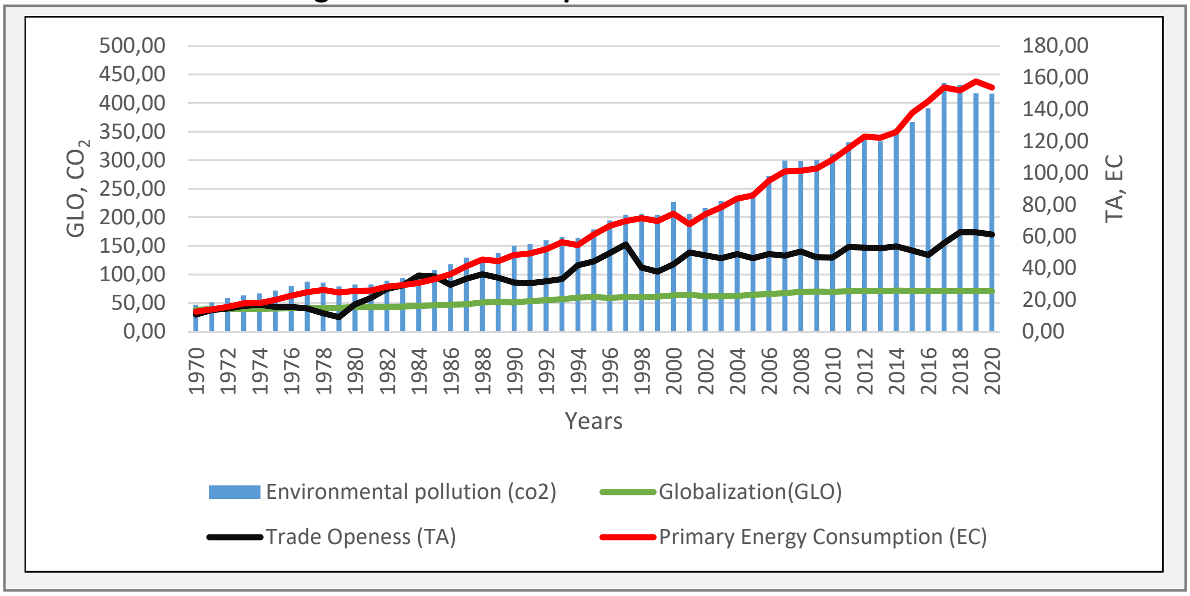


Source: Prepared by using WDI database.

According to the data in Figure 5, CO_2 emissions per capita showed an increase each year- they increased 269% from 1970 until 2020. While CO_2 emission was 3.35 ton per capita in 1970, it is found that it was 4,997 ton per capita in 2020. A positive relationship is observed between the economic growth in Turkey in 1970-2020 and CO_2 emission (environmental pollution). In other words, economic growth in Turkey has increased environmental pollution due to dense fossil fuel consumption, which then causes global warming. In this connection, it is believed that in order to decrease environmental pollution and prevent global climate changes, instead of using fossil fuels, use of renewable energy sources (water, biomass, geothermal, wind, solar energy etc.) could be a solution (Menyah & Wolde-Rufael, 2010: 2911). Due to the shortage of fossil fuels, the enhancement of the price, its dependence on foreign sources, and causing to environmental pollution, countries turn to alternative energy sources (Mert et al., 2015: 46).

Scale, technique and composition effects that are used in the first approach in explaining globalization-environment relationship, are also used in clarifying the terms of economic growth, and openness (Antweiler, 2001: 877-878, Yilmaz & Dilber, 2020: 461). For this reason, the impact of economic growth and openness on environment is related to scale, technical and composition effects. Because in less developed and developing countries technical effect is less dominative compared to scale and composition effects, environmental pollution is likely to increase as the economy grows and becomes open to foreign countries. On the other hand, since in developed countries technical effect is more predominant over scale and composition effects, pollution can possibly decrease as the economy grows and becomes open to foreign countries. In Figure 6, as a developing country, the relationships between Turkey's globalization, primary energy consumption, urbanization, commercial openness in 1970-2020 period and CO_2 variables are demonstrated.

Figure 6: Relationships Between Relevant Variables



Source: Prepared by using WDI database.

When Figure 6 is examined, it is shown that there is a positive relationship between variables and CO_2. It is particularly observed that CO_2 changes in parallel with fossil-based energy consumption levels, and that it is the greatest factor which effects environmental pollution.

In literature, the fact that a great deal of analysis being conducted related to globalization, economic growth, energy consumption, urbanization and environmental pollution, and that these analyses give different results from each other have shown the necessity of reviewing and updating the data for Turkey. Accordingly, in the study, the connections between globalization, economic growth, energy consumption, urbanization in Turkey and environmental pollution are investigated. The contributions of obtained results to literature are evaluated as such: In the study, besides globalization variable that effects environmental pollution, GRW, TA, GLO, EC variables are also added to make it more extensive. The series being handled in the study are updated including 51-year period (1970-2020). Since the first record related to environmental pollution in the analysis belongs to 1970, it is determined to be the year of starting.

2. Literature Review

It has been discussed in the literature that whether variables that have vital importance for an economy such as globalization, economic growth, energy consumption, and trade openness are good for ecological balance. In the surveys, environmental pollution is centered as the element of ecological balance, and carbon dioxide emissions (CO_2) are handled as representative of environmental pollution. Theoretical literature anticipates both positive and negative effects of the related variables on environmental pollution in discussed countries according to their level of development. The studies conducted at international level are shown in Table 1, and the studies conducted at national level are in Table 2.

Table 1: Studies Conducted at International Level

Writer(s)	Variables	Countrie(s)/Data set	Method	Conclusion
Menyah & Rafuel (2010)	Y, NC, RC, CO_2	USA 1960 – 2007	Granger Causation	•Y↔ CO_2 • CO_2→RC •NEC→ CO_2
Chang (2010)	Y, PC, KC, NC, ELC, CO_2	Chinese 1981 – 2006	Johansen Cointegration, VECM Granger Causation	•Y↑, ELC↑ => CO_2↑ •Y→ CO_2 •KC ↔ CO_2
Hatzigeorgio et al. (2011)	Y, EY, CO_2	Greece 1977 – 2007	Johansen Cointegration, VECM Granger Causation	•Y↑, EY↑ => CO_2↑ •Y, EY→ CO_2 (KD) •Y→ CO_2 (UD) •EY ↔ CO_2 (UD)
Pao et al. (2011)	Y, Y^2, EC, CO_2	Russia 1990 – 2007	Johansen Cointegration, VECM Granger Causation	•Y, EC ↔ CO_2 (UD) • CO_2→Y (KD) • CO_2 →Y (KD) •EKC –
Sharma (2011)	EC, ELC, CO_2, TA, URB	69 Countries 1985 – 2005	Panel Data Analysis	•ELC↑ => CO_2↑ (High Income Countries) •EC↑ => CO_2↑ (High Income Countries) •Y↑ => CO_2↑ (All Country Groups) •TA, URB Statistically Meaningless
Hossain (2012)	Y, EC, TA, URB, CO_2	Japan 1960 – 2009	ARDL, Johansen Cointegration, VECM Granger Causation	•EC↑ => CO_2↑ (UD) •TA↑ => CO_2↓ (UD) •EC↑ => CO_2↑ (KD) •TA↑ => CO_2↓ (KD) •EC, TO→ CO_2 (KD) •CO_2→Y (KD) •Y, EC, URB→ CO_2 (UD) •TA→ CO_2 (UD)
Alam et al. (2012)	Y, EC, ELC, CO_2	Bangladesh 1972-2006	Johansen Cointegration, VECM Granger Causation	•Y↑, EC↑ => CO_2↑ (UD) •Y↑, EC↑ => CO_2↑ (KD) • CO_2→Y (UD) •EC ↔ CO_2 (UD) • CO_2 →Y (KD)
Javid & Sharif (2013)	Y, Y2, EC, TA, FD, CO_2	Pakistan 1971 – 2011	ARDL, VECM Granger Causation	•Y↑, EC↑ => CO_2↑ (UD) •FD↑, TA↑ => CO_2↑(UD) •Y↑, EC↑ => CO_2↑(KD) •FD↑, TA↑ => CO_2↑(KD) • Y, EC, FD, TA → CO_2 (UD) • Y, FD → CO_2 (KD) • EC ↔ CO_2 (KD) •EKC –
Boutabba (2014)	Y, Y^2, EC, FD, TA, CO_2	India 1971 – 2008	ARDL, VECM Granger Causation	•Y↑, EC↑ => CO_2↑ (UD) •FD↑ => CO_2↑ (UD) • Y, EC => CO_2↑ (KD) • Y, FD → CO_2 (UD) • EC ↔ CO_2 (UD) •EKC +
Lau et al. (2014)	Y, Y^2, TA, FDI, CO_2	Malaysia 1970 – 2008	ARDL, VECM Granger Causation	•Y↔EC •TA, FDI→ CO_2 •EKC +
Farhani et al. (2014)	Y, Y^2, EC, TA, CO_2	Tunisia, 1971 – 2008	ARDL, VECM Granger Causation	• Y↑, EC↑ => CO_2↑ (UD) •TA↑ => CO_2↑ (UD) •Y↑, EC↑=> CO_2↑ (KD) •TA↑ => CO_2↑ (KD)

				•Y, EC → CO_2 (KD) •Y, EC ve TA → CO_2 (UD) • CO_2 →EC (UD) •EKC +
Shahbaz et al. (2015)	Y, KC, GLO, EG, SG, PG	India 1970 – 2012	ARDL, Bayar-Hanck Cointegration, VECM Granger Causation	• Y↑, KC ↑ => CO_2↑ (UD) • Y↑, KC ↑ => CO_2↑ (KD) • GLO↑, EG↑ => CO_2↓ (UD) •SG↑, PG↑ => CO_2↓ (UD) •Y, KC, FDB → CO_2 (UD) •EG, SG, PG → CO_2 (UD) • KC→ CO_2 (KD) • Y↔ CO_2 •EKC +
Doğan & Turkekul (2016).	Y, Y^2, CO_2, EC, URB, TA, FD	USA 1960 – 2010	ARDL	CO_2 ↔ Y CO_2 ↔ EC CO_2 ↔ URB Y → URB Y → TA Y→ EC FD → Y URB → FD
Anwar & Alexander (2016)	Y, EC, TA, CO_2	Vietnam 1980 – 2011	ARDL, Gregory-Hansen Cointegration	• Y↑, EC↑ => CO_2↑ • TA↑ => CO_2↓
Ertugrul et al. (2016)	Y, Y2, EC, TA, CO_2	11 Developing Countries 1971-2011	ARDL, VECM Granger Causality	•TA↑ => CO_2↑ (**Turkey**, India, Chinese and Indonesia) •Y, EC, TO → CO_2 (UD) (**Turkey**, Thailand, India, Indonesia, China, Brazil and South Korea) •Y, EC, TO ↔ CO_2 (UD) (Brazil and China)
Yii & Geetha (2017)	Y, ELC, EF, PT, CO_2	Malaysia 1971 – 2013	ARDL, VECM Granger Causality, Toda-Yamamoto Causality	• Y↑ => CO_2↑ (KD) • EF↑ => CO_2↓ (KD) • Y, ELC, PT → CO_2 (KD) •ELC, EP → CO_2 (UD) •Y ↔ CO_2 (UD)
Gullu & Yakisik (2017)	Y, EC, CO_2	MIST Countries 1971-2010	Johansen Cointegration, Granger Causality, Todo-Yamamoto Causality	•Y→ CO_2 (Indonesia, South Korea and Turkey) • CO_2→Y (Meksika) •EC → CO_2 (Indonesia)
Audi & Ali (2018)	Y, GLO, NY, CO_2, EC	MENA Countries, 1980 – 2013	ARDL	•Y↑=> CO_2↑ •GLO↑=> CO_2↑ •EY↑=> CO_2↑ •NY↑=> CO_2↑ •EC↑=> CO_2↑ •Y, EC→ CO_2 •NY, CO_2, Y→EC •NY, GLO, CO_2→Y
Salahuddin et al. (2018)	Y, ELC, FD, FDI, CO_2	Kuwait 1980 – 2013	ARDL, DOLS, VECM, Granger Causality	•Y↑, ELC↑ => CO_2↑ (UD) •FD↑, FDI↑ => CO_2↑ (UD) •Y↑, ELC↑ => CO_2↑(KD) •FDI↑ => CO_2↑(KD) •Y, ELC, FDI→ CO_2
Zaidi et al. (2019)	Y, Y^2, EY, GLO, FD, CO_2	APEC Countries, 1990 – 2016	CUP-BC, CUP-FM	•GLO↑, FD↑ => CO_2↓ (UD) •Y↑ => CO_2↓ (UD) •Y↑, ELY↑ => CO_2↑ (UD) •FD ↔ CO_2 (UD)

				• Y, FD, GLO$\rightarrow$EY (UD) •EKC +
Rafindadi & Usman (2019)	Y, Y^2, GLO, EC, CO_2	South Africa, 1971 – 2014	FMOLS, CCR, ECM	•Y$\uparrow$=> $CO_2\uparrow$ •$Y^2\uparrow$=> $CO_2\downarrow$ •GLO$\uparrow$=> $CO_2\uparrow$ •EC$\rightarrow$ CO_2 •Y $\leftrightarrow$ GLO •EKC +
Khan et al. (2019)	Y, FD, FDI, TA, MB, EG, SG, PG, URB, CO_2	Pakistan 1971 – 2016	ARDL	• FD$\uparrow$, TA$\uparrow$=> CO2$\uparrow$ •SG$\uparrow$, EG$\uparrow$=> CO2$\uparrow$
Liu et al. (2020)	Y, RE, GLO, CO_2	G7 Countries 1970 – 2015	Panel Time Series	GLO$\uparrow$ => CO_2 (Before $\uparrow$, after $\downarrow$) •Y$\uparrow$ => $CO_2\uparrow$ •RE$\uparrow$=> $CO_2\downarrow$
Usman (2020)	Y, Y^2, CO_2, EG, SG, PG	Singapore, 1970 – 2014	ARDL	•EG$\uparrow$, SG$\uparrow$=> $CO_2\downarrow$ •PG$\uparrow$=> $CO_2\uparrow$ (UD) •PG$\uparrow$=> $CO_2\downarrow$ (KD) •EKC +
Mehmood (2020)	Y, NRC, EG, SG, PG, CO_2	Singapore 1970 – 2014	ARDL, Granger Causality	•EG$\uparrow$, SG$\uparrow$=> $CO_2\downarrow$ •Y $\uparrow$, PG $\uparrow$=> $CO_2\uparrow$ •Y $\rightarrow$ CO_2
Adebayo et al. (2021)	Y, GLO, EC, RE, CO_2	South Korea 1980 – 2018	ARDL	•EC$\uparrow\rightarrow$ $CO_2\uparrow$ •GLO$\uparrow\rightarrow$ $CO_2\uparrow$
Rahman et al. (2021)	Y, Y^2, EC, GLO	BRICS Countries, 1989 – 2019	FMOLS, DOLS	•EC$\uparrow$=> $CO_2\uparrow$ (UD) •GLO$\uparrow$=> $CO_2\downarrow$ (UD) •EKC –
Wen et al. (2021)	GLO, NRC, Y, Y^2, CO_2	South Asian Countries, 1985 – 2018	FMOLS	• NRC$\uparrow$, GLO $\uparrow$=> $CO_2\uparrow$ •EKC – (India) •EKC + (Other countries)
Akbulut Yıldız (2021)	CO_2, EC, TA	OPEC Member 6 Middle East Countries 2003 – 2014	Panel ARDL, PMG Estimator, VECM	•EC $\uparrow$ => $CO_2\uparrow$ (UD) •TA$\uparrow$ => $CO_2\downarrow$ (UD) •EC $\rightarrow$ CO_2 (KD) • CO_2 $\rightarrow$ TA (UD) • $CO_2\rightarrow$ EC (UD) EC $\leftrightarrow$ TA (UD)
Tekbaş (2022)	Y, Y^2, EC, EG, CO_2	14 Transit Countries 1995 – 2014	FMOLS, Dumitrescu-Hurlin Causality Test	•Y$\uparrow$=> $CO_2\uparrow$ •$Y^2\uparrow$=> $CO_2\downarrow$ •EC $\uparrow$, EG$\uparrow$ => $CO_2\uparrow$ •Y, EG $\leftrightarrow$ CO_2 •EG $\rightarrow$ CO_2 •EKC +

Table 2: Studies for Turkey

Yazar(lar)	Değişkenler	Veri Seti	Metot	Sonuç
Halıcıoğlu (2009)	Y, Y^2, EC, TA, CO_2	Turkey 1960 – 2005	ARDL, Johansen ve Juselius Cointegration ve Granger Causality	•EC$\uparrow$, Y$\uparrow$ => $CO_2\uparrow$ (UD) •TA$\uparrow$ => $CO_2\uparrow$ (UD) •Y $\leftrightarrow$ CO_2 (KD) • Y $\leftrightarrow$ CO_2 (UD) • EC$\leftrightarrow$ CO_2 (KD) •EKC –
Soytaş & Sarı (2009)	Y, EC, L, SS, CO_2	Turkey 1960 – 2000	VAR ve Toda-Yamamoto Nedensellik	CO_2 $\rightarrow$ EC
Ozturk & Acaravci (2010)	Y, EC, L, CO_2	Türkiye 1968 – 2005	ARDL, ECM Granger Causality	EC $\rightarrow$ CO_2
Altintas (2013)	Y, EC, INV, CO_2	Turkey 1970 – 2008	Johansen ve Juselius Cointegration, ARDL,	•EC$\uparrow$, INV$\uparrow$ => $CO_2\uparrow$ •Y, EC$\rightarrow$ CO_2 (KD) •Y, EC, INV$\rightarrow$ CO_2 (UD)

			VECM Granger Causality	• EC, I ↔ CO_2
Shahbaz et al. (2013)	Y, Y^2, EC, GLO, CO_2	Turkey 1970-2010	Gregory –Hansen Cointegration Test, ARDL, VECM Granger Causality	•Y↑, EC↑ => CO_2↑ (UD) •GLO↑=> CO_2↓ (UD) •Y↑, EC↑ => CO_2↑ (KD) •GLO↑=> CO_2↓ (KD) •Y^2↑=> CO_2↓ •Y, EC↔ CO_2 •GLO→ CO_2 •EKC +
Çetin & Seker (2014)	Y, FTY, CO_2	Turkey 1980 – 2010	ARDL	•Y↑, FTY↑ => CO_2↑ (UD) •Y↑ => CO_2↑ (KD)
Bozkurt & Okumuş (2015)	Y, EC, TA, NY, CO_2	Turkey 1966- 2011	Hatemi-J Cointegration Test, FMOLS	•Y↑, EC↑ => CO_2↑ •Y^2↑=> CO_2↓ •TA↑, NY↑ => CO_2↑ •EKC +
Gökmenoğlu & Taşpınar (2015)	Y, EC, FDI, CO_2	Turkey 1974 – 2010	ARDL, Toda- Yomamoto Causality	•Y↑ => CO_2↓ (UD) •Y↑ => CO_2↑ (KD) •Y↑ => CO_2↑ (KD) •Y^2↑=>CO_2↓ •EC↑, FDI↑ => CO_2↑ (UD) •EC↑ => CO_2↑ (KD) • EC, FDI↔ CO_2 •EKC +
Şeker et al. (2015)	Y, Y^2, EC, FDI, CO_2	Turkey 1974 – 2010	ARDL, Hatemi-J Cointegration, VECM Granger Causality	•Y↑, EC↑, FDI↑ => CO_2↑ •Y^2↑=> CO_2↓ •Y, EC → CO_2 (UD) •FDI↔ CO_2 (UD) •CO_2→EC, FDI (KD) •EKC +
Kızılkaya et al. (2016)	Y, EC, TA, CO_2	Turkey 1967 – 2010	Johansen Cointegration	•Y↑, EC↑, TA↑ => CO_2↑
Lebe (2016)	Y, Y^2, EC, FD, TA, CO_2	Turkey 1960 – 2010	ARDL, VECM Granger Causality	•Y↑, EC↑ => CO_2↑ •Y^2↑=> CO_2↓ •FD↑, TA↑ => CO_2↑ •FD→ CO_2 (KD) •EC ↔ CO_2 (UD) •TA→ CO_2 (UD) •EKC +
Pata (2018)	Y, Y^2, EC, URB, FD, RE, CO_2	Turkey 1974-2014	FMOLS, DOLS, CCR, ARDL	•Y↑=> CO_2↑ •Y^2↑=> CO_2↓ •FD↑=> CO_2↑ •URB↑=> CO_2↑ •EC↑=> CO_2↑ •RE istatistiki olarak anlamsız
Aykırı & Bulut (2019)	Y, FDI, EG, CO_2	Turkey 1975 – 2014	Johansen Cointegration, FMOLS, DOLS, CCR	•Y↑, FDI↑, EG↑ => CO_2↑
Kurt et al. (2019)	Y, EC, FDI, CO_2	Turkiye 1974 – 2014	ARDL	•FDI↑, EC↑ => CO_2↑ •Y↑ => CO_2↓
Kuzu & Hopoğlu (2019)	GLO, CO_2	Turkey 1970 – 2017	Hatemi-J Causality	• GLO→ CO_2
Demir et al. (2020)	Y, EC, FD, URB, BS, PT, PT^2, CO_2	Turkey 1971 – 2013	ARDL, VECM	•Y↑, FD↑ => CO_2↑ (UD) •URB↑, PT↑ => CO_2↑ (UD) •EC↑, BS↑=> CO_2↓ (UD) •PT^2↑=> CO_2↓ (UD)
Kılıç et al. (2020)	EC, URB, SN, CO_2	Turkey 1960-2014	ARDL	•EC↑, URB↑ => CO_2↑ •SN↑ => CO_2↑

Okumuş (2020)	Y, Y^2, NRC, RC, TA, URB, CO_2	Turkey 1968 – 2014	ARDL	•Y^2↑, RC↑=> CO_2↓ (KD) •Y^2↑, RC↑=> CO_2↓ (UD) •NRC↑, AGR↑=> CO_2↑ •TA↑. URB↑ => CO_2↑ •EKC +
Özdemir & Koç (2020)	Y, Y^2, Y^3, EC, RC, TA, CO_2	Turkey 1960 – 2017	ARDL	•Y↑, EC↑=> CO_2↑ (UD) •TA↑ => CO_2↑ (UD) •RC↑=> CO_2↓ (UD) •Y↑, EC↑=> CO_2↑(KD) •EKC –
Çoban & Özkan (2022)	Y, Y^2, GLO, CO_2,	Turkey 1970 – 2019	ARDL	•GLO↑ => CO_2↑ (UD) •Y↑=> CO_2↑ •Y^2↑=> CO_2↓ •EKC +
Oluç & Güzel (2022)	FG, Y, Y^2, CO_2	Turkey 1970 – 2017	FMOLS, DOLS, CCR, ARDL	•FG↑=> CO_2↑ (UD) •Y↑=> CO_2↑ •Y^2↑=> CO_2↓ •EKC +
Göv & Kapkara (2023)	TRS, MTR, EC, FDI, Y, UN, TEC, TA, ÇV, FD	Turkey 1998-2019	LASSO	•ÇV↑=> CO_2↓ •FDI↑, Y↑, MTR↑ => CO_2↑ •FD↑, EC↑, TEC↑ => CO_2↑ • The effect of TRS, TA and UN on CO_2 is insignificant.

=>: if, **↑**: Increase, **→**: One-sided Causality, **↓**: Decrease, **↔**: Two-sided Causality, **BS:** Human Capital, **CO_2:** Carbon dioxide, **ÇV:** Environment Tax, **EC:** Primary Energy Consumption, **EF:** Energy Prices, **EG**: Economic Globalization, **EKC –** : Environmental Kuznets Hypothesis Not valid, **EKC +:** Environmental Kuznets Hypothesis Valid, **ELC:** Electricity Consumption, **EY:** Energy Density, **FG:** Financial Globalization, **FD:** Financial Growth, **FDI:** Direct Foreign Investments, **FEC:** Fossil Energy Consumption, **TY:** Foreign Trade Density, **INV**: Investment, **KC:** Coal Consumption, **KD:** Short Term, **MB:** Trademark Application, **MTR:** Number of Motor Vehicle, **NC**: Natural Gas Consumption, **NEC:** Nuclear Energy Consumption, **NRC:** Non-renewable Energy Consumption, **NY:** Population Density, **PC:** Petrol Consumption **PG:** Political Globalization, **PT:** Patent, **RC:** Renewable Energy Consumption, **SA:** Health Expenses, **SB:** Capital Accumulation, **SG**: Social Globalization, **SN:** Industrialization, **SS:** Gross Fixed Capital, **TA**: Trade Openness, TEC, High Technology Export, **TRS:** Number of Tourists, **UD:** Long Term, **UN:** Urban Population **URB:** Urbanization, **Y:** National Income or Economic Growth, **Y^2:** Square of Income or Economic Growth

Literature shows inconsistent or complicated results in consequence of using different econometric techniques in the research and examining different time dimensions and number of countries.

3. Dataset and Methodology

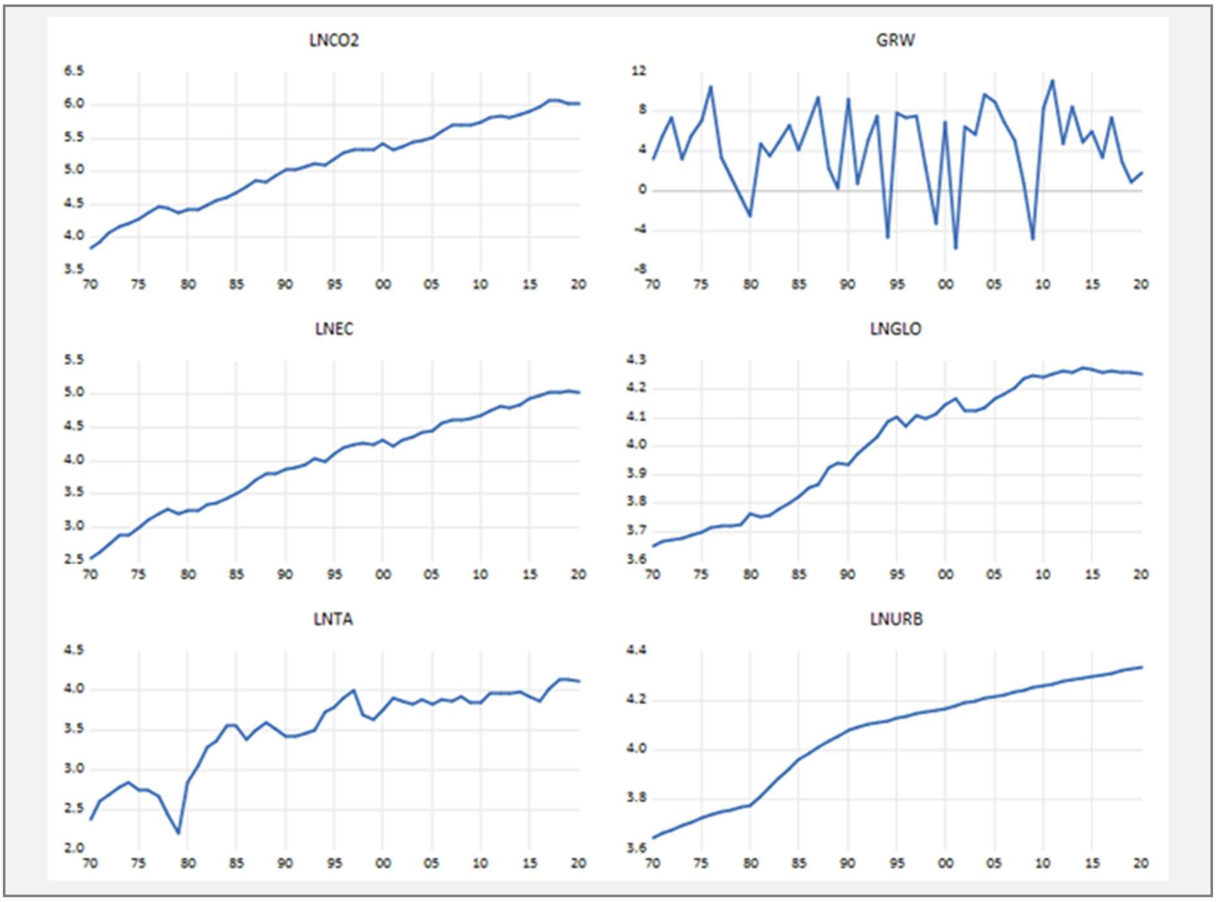
The variables used in the study, abbreviations of the variables, resources, and time period of the variables are demonstrated in Table 3.

Table 3: Series Used in the Study

Abbreviations	Variables	Source	Time Range
lnCo2	Carbon Dioxide Emissions Per Capita	Edgar	1970 – 2020
GRW	Economic Growth (2010=100)	WDI	
lnGLO	KOF Globalization Index	KOF	
lnEC	Primary Energy Consumption (Million Tons of Oil Equivalent)	BP	
lnTA	Trade Openness (% GDP)	WDI	
LnURB	Urbanization (% Total population)	WDI	

In Table 3, as GRW variable contains negative valence, its logarithm is not taken. The other variables are made into logarithmic transformation, and in symbol is added before them. Figure 7 indicates the graphics of series used in the study.

Figure 7: Graphics of Variables



When the graphics related to the variables are examined in Figure 7, the variables except GRW variable are interpreted as being not stationary. Yet, it has been decided that unit root test will be applied on variables to determine whether the series are stationary or not. In Table 4, descriptive statistics concerning variables are given.

Table 4: Descriptive Statistics

	LNCO2	GRW	LNEC	LNGLO	LNTA	LNURB
Mean	5.1139	4.4817	3.9960	4.0071	3.5072	4.0603
Median	5.1850	5.0356	4.1124	4.0888	3.6987	4.1291
Maximum	6.0750	11.200	5.0608	4.2771	4.1369	4.3321
Minimum	3.8484	-5.7500	2.5346	3.6517	2.2082	3.6437
Std. Dev.	0.6369	4.0243	0.7231	0.2197	0.5248	0.2181
Skewness	-0.2133	-0.7686	-0.2763	-0.2880	-0.9210	-0.5781
Kurtosis	1.8934	3.1141	1.9605	1.5326	2.6417	1.9228
Jarque-Bera	2.9886	5.0501	2.9450	5.2805	7.4842	5.3070
Probability	0.2244	0.0800	0.2293	0.0713	0.0237	0.0704
Sum	260.81	228.57	203.80	204.36	178.87	207.07
Sum Sq. Dev.	20.287	809.78	26.149	2.4137	13.775	2.3786
Observations	51	51	51	51	51	51

When the data in Table 4 is examined, if standard deviation is taken into account as the measure of change, it is observed that GRW variable has the outmost difference between maximum and minimum value, that it is the variable which has the biggest standard deviation, coefficients of skewness of variables are left-skewed because they contain negative asymmetry, that coefficients of kurtosis are more kurtic than usual as they contain positive asymmetry. In addition, the Jarque-Bera probability (P) values of the variables were found to have normal distribution, except for the lnTA variable, as P>0.05.

The economic model used in the study is LnCO2 = f(GRW, LnEC, LnGLO, LnTA, LnURB). In the model, LnCO2 is employed as dependent variable whereas variables in the paranthesis (GRW, LnEC, LnGLO, LnTA, LnURB) are independent variables.

For the analysis of the model ARDL (Autoregressive Distributed Lag) bound testing has been practiced. In the choice of method, with the condition that in the level of stationary orders of the variables (I[0]) or in the first lag ([1]) being stationary or having the combination of both, in the second lag (I[2]) of variables being non-stationary, it has been influential that it allows to analyze with stable variables in different levels. (Pesaran et al., 2001: 300-301). ARDL bound testing is generally modelled with the inclusion of current values and deferred values of independent variables, and deferred values of dependent values (Enders, 2010: 405-406). ARDL bound testing operates in two stages. In the first stage, long-run cointegration relationship between the series included in the analysis is tested. If there exists cointegration relationship, long-run coefficient prediction is made first, and after that short-run error-correction coefficient prediction is made (Narayan & Smyth, 2005: 103).

4. Data Analysis and Findings

The variables used in the model need to be stationary in order to apply ARDL test that is chosen for analyzing the model. Accordingly, variables have been applied ADF and KPSS stationarity tests and reported in Table 5.

Table 5: Stationarity Testing on Level Values of the Series

	ADF*			KPSS**		
Variables	Test İst.	%1	%5	Test İst.	%1	%5
lnCo2***	-2.943501	-4.152511	-3.502373	0.194786	0.216000	0.146000
GRW***	-6.773359	-3.568308	-2.921175	0.037717	0.739000	0.463000
lnEC***	-2.681862	-4.152511	-3.502373	0.213374	0.216000	0.146000
lnGLO***	4.325264	-2.612033	-1.947520	0.923590	0.739000	0.463000
lnTA***	-1.890469	-3.568308	-2.921175	0.852363	0.739000	0.463000
lnURB***	1.468545	-2.614029	-1.947816	0.909696	0.739000	0.463000

*: MacKinnon (1991). **: Kwiatkowski et al. (1992). *** lnCO2, lnEC with Constant and Trend, GRW, lnTA with Constant, lnGLO, lnURB No Trend and No Constant are included in the analysis according to the SC information criteria, taking into account the automatic delay length determined by the Eviews 12 program.

According to Table 5, all the variables except GRW variable contain unit root. In other words, GRW variable has proven stationarity on the level.

Table 6: First Lag of the Series

	ADF*			KPSS**		
Variables	Test İst.	%1	%5	Test İst.	%1	%5
lnCo2***	-6.531524	-4.156734	-3.504330	0.047108	0.216000	0.146000
lnEC***	-7.333374	-4.156734	-3.504330	0.057167	0.216000	0.146000
lnGLO***	-5.061495	-2.613010	-1.947665	0.313821	0.739000	0.463000
lnTA***	-6.101139	-3.571310	-2.922449	0.128773	0.739000	0.463000
lnURB***	-4.860496	-2.625606	-1.949609	0.451984	0.739000	0.463000

*: MacKinnon (1991). **: Kwiatkowski et al. (1992). *** lnCO2, lnEC with Constant and Trend, GRW, lnTA with Constant, lnGLO, lnURB No Trend and No Constant are included in the analysis according to the SC information criteria, taking into account the automatic delay length determined by the Eviews 12 program.

According to Table 5 and 6, GRW series is stationary on the level, while the other series are stationary in the first lag. The fact that some of the series are stationary on the level, and some others are in the first lag, and that none of the series are stationary in the second lag are sufficient conditions for the appliance of ARDL bound testing.

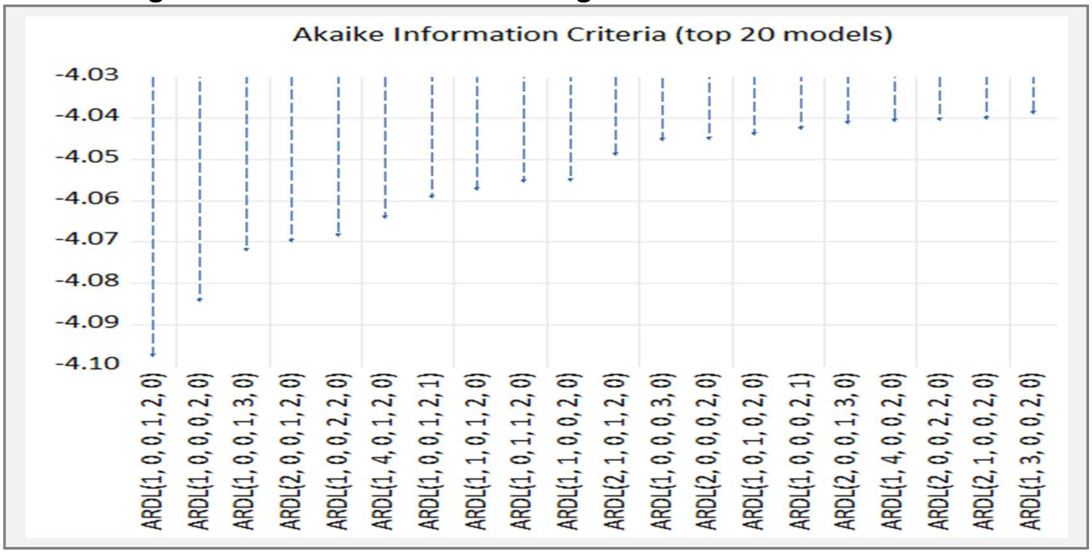
Table 7: Optimal Lag Length in Related to VAR Model

Endogenous variables: CO2 GRW EC GLO LNTA URB Exogenous variables: C						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	120.0236	NA	3.15e-10	-4.852068	-4.615879	-4.763188
1	421.1334	512.5273	4.02e-15	-16.13334	**-14.48001***	-15.51118
2	485.9771	**93.81641***	**1.27e-15***	**-17.36073***	-14.29027	**-16.20529***
3	515.6136	35.31164	2.04e-15	-17.08994	-12.60235	-15.40123
4	551.3930	33.49559	3.20e-15	-17.08055	-11.17583	-14.85857

* Appropriate lag length

In Table 7, all of the four-information criterion (FPE, LR, AIC, HQ) have identified convenient lag lenth 2. Eviews 12 package software has concluded that among 12500 models, ARDL (1, 0, 0, 1, 2, 0) is the most suitable model. This state is reported in Figure 8.

Figure 8: Best 20 Models According to AIC Information Criterion



ARDL model is set by taking into account zero lag I(0) of economic growth, primary energy consumption and trade openness variables, one lag I(1) of pollution and globalization variables, and 2 lag I(2) of urbanization variable. In the light of these, in Table 8 detailed information can be found for ARDL (1, 0, 0, 1, 2, 0) model.

Table 8: ARDL (1, 0, 0, 1, 2, 0) Detailed Information

The dependent variable: lnCO2				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCO2(-1)	0.282776	0.079630	3.551120	0.0010
GRW	0.002250	0.000875	2.571212	0.0141
LNEC	0.624087	0.077561	8.046407	0.0000
LNGLO	0.053173	0.346262	0.153562	0.8787
LNGLO(-1)	0.432189	0.382796	1.129034	0.2658
LNURB	3.819949	1.027490	3.717749	0.0006
LNURB(-1)	7.732881	1.803835	4.286911	0.0001
LNURB(-2)	4.444920	1.035065	4.294340	0.0001
LNTA	0.028247	0.042410	0.666055	0.5093
C	1.280965	0.545253	2.349301	0.0240
$\bar{R}^2 = 0.99$, F=2412.211 P (0.000), DW=1.837889				
Diagnostic Tests				
Wald Test: F= 133.6730 (0,000)				
Serial Correlation (Breush-Godfrey): F=0,50 (P=0,61)				
Model Specification (Ramsey – Reset): F=3,61 (P=0,06)				
Normallik (Jarque-Bera): JB=2,03 (P=0,36)				
Heteroscedastıcıty (Breush-Pagan-Godfrey): F=0,67 (0,73)				

Table 8 indicates R^2, corrected R^2, F- statistics, Durbin Watson statistics values and diagnostic tests for the convenient model ARDL. These values confirm that the model chosen is the right model.

Upon confirming that it is the right model, F-statistics value and bound testing results will be evaluated for ARDL model in which LnCO2 is dependent variable whereas GRW, LNEC, LNGLO, and LNURBare independent variables.

Table 9: Bound Testing Results for ARDL

F- statistic: 15.28527 ve k:5	Limit Values	
	I (0)	I (1)
10%	2.26	3.35
5%	2.62	3.79
1%	3.41	4.68
T-statistic: -6.356945	Limit Values	
	I (0)	I (1)
10%	-2.57	-3.86
5%	-2.86	-4.19
1%	-3.43	-4.79

According to this, between GRW, LNEC, LNGLO, LNTA, LNURB series and LnCO2 series, there is a long run cointegration relationship.

Table 10: Long-Run Bound Testing Results for ARDL(1, 0, 0, 1, 2, 0)

The dependent variable: LnCO2				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GRW	0.003137	0.001447	2.167996	0.0363
LNEC	0.870142	0.068201	12.75853	0.0000
LNGLO	0.676723	0.222249	3.044885	0.0042
LNURB	0.741733	0.274390	2.703206	0.0101
LNTA	0.039384	0.058389	0.674516	0.5040
EC = LNCO2 – (0.0031*GRW + 0.8701*LNEC + 0.6767*LNGLO + 0.7417*LNURB)				

When long-run estimated results are examined, it is seen that coefficients of GRW, LNEC, URB ve LNGLO series are statistically significant, and affects LnCO2 series positively. The coefficient of LNTA variable is statistically insignificant.

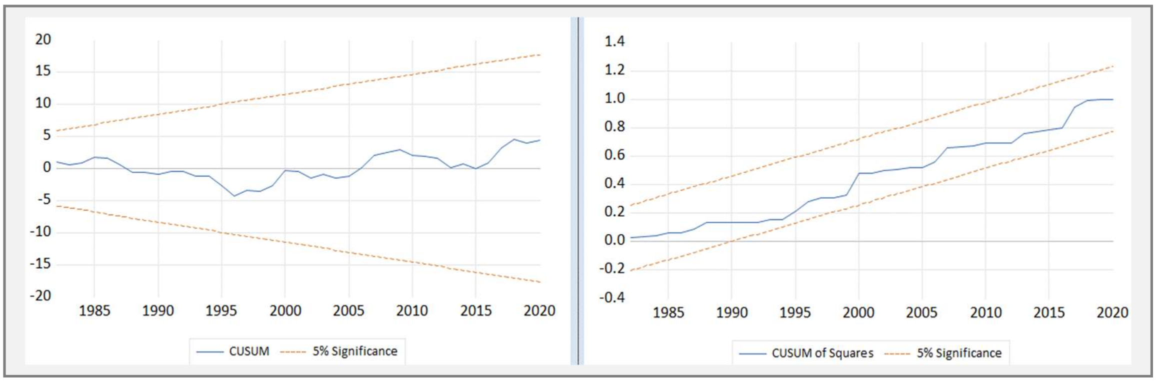
Table 11: Short-Term ARDL Error Correction Estimated Results

The dependent variable: LnCO2				
	Coefficient	Std. Error	t-Statistic	Prob.
C	1.280965	0.123777	10.34900	0.0000
D(LNGLO)	0.053173	0.216463	0.245642	0.8072
D(LNURB)	3.819949	1.038538	3.678199	0.0007
D(LNURB(-1))	4.444920	1.055445	4.211418	0.0001
CointEq(-1)	-0.717224	0.070510	-10.17200	0.0000

In Table 11, as it can be seen in the results of error correction model, negative and statistically significant value(P:0,0000), of error correction term (CointEq(-1)), with the effect of a shock that affects CO2 is corrected 72% in a year, and nearly in 1.3 year it reaches long-term balance.

In Figure 9, reports of CUSUM and CUSUMSQ tests are indicated to control the stabilization of ARDL model.

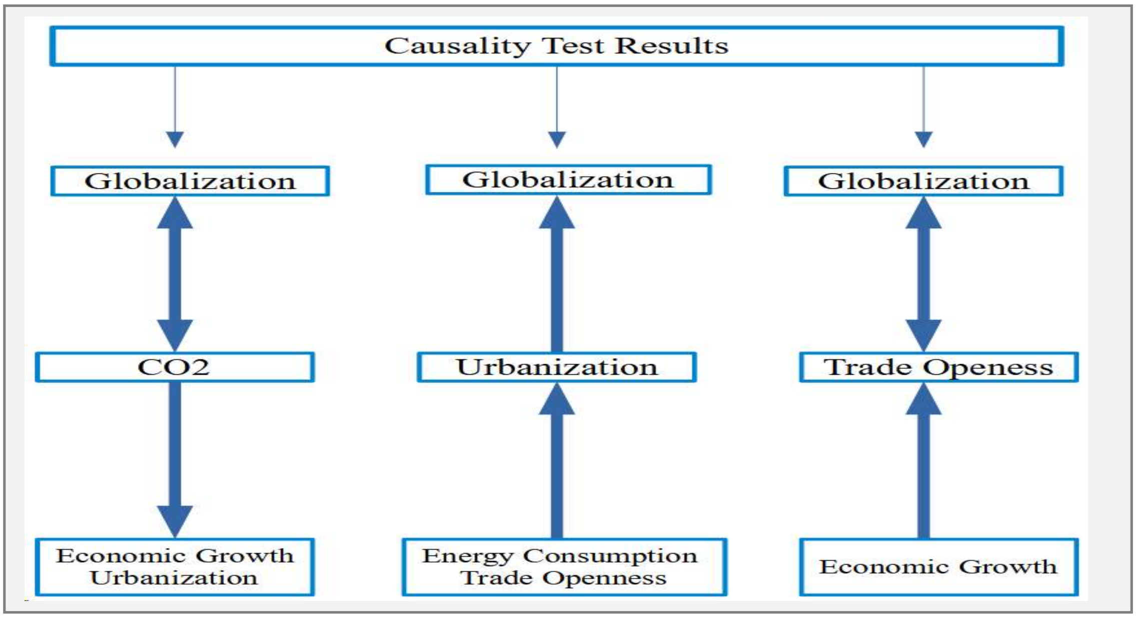
Figure 9: Cusum and Cusumsq Graphics



Cusum and Cusumsq graphics in Figure 9 show that both of them are located between blue-colored upper and lower limits, and that the chosen model is a decisive model.

In order to search for the causality relationships between series used in ARDL model, Toda-Yamamoto (1995) causality test which is based on extended VAR system is preferred. In the preference of this method, the constraints being minimalized such as whether series are stationary, whether they are on the same level integrated and/or cointegrated have been influential. For Toda-Yamamoto causality test, lag length based on VAR method needs to be calculated in terms of information criteria.

Figure 10: Toda- Yamamoto Causality Test



5. Conclusion

This study centers upon the discussion point whether in Turkey globalization increased environmental pollution in the period between 1970-2020. It also includes economic growth, primary energy consumption, trade openness and urbanization variables into the analysis, and investigates the relationships between related variables and environmental pollution. In order to investigate the relationship between variables, the stationarity of the variables is necessary. For this reason, the stationarity state of the variables has been examined by using PP and ADF tests. Test results indicate that the series are stationary in I(0) and I(1), and that none of the series are stationary in I(2). In this regard, ARDL model is preferred to prove cointegration relationship between variables.

According to ARDL test results, in the long run in Turkey a positive and statistically significant relationship is existent between economic growth, energy consumption, urbanization and globalization variables and environmental pollution. Accordingly, 1% increase in economic growth, energy consumption, globalization and urbanization also increase environmental pollution positively and with rates 0.3%, 9%, 7%, 7% respectively. These variables can be said to have been the main factors of environmental degradation in Turkey. The results obtained from the study overlap with the results of a study that takes place in national and international literature (Halıcıoğlu, 2009; Hatzigeorgio et al., 2011; Alam et al., 2012; Javid & Sharif, 2013; Farhani et al., 2014; Seker et al., 2015; Yii & Geetha, 2017; Audi & Ali, 2018; Rafindadi & Usman, 2019; Demir et al., 2020; Coban & Ozkan, 2022; Tekbas, 2022; Göv & Kapkara, 2023). The variable of trade openness has been found to be statistically insignificant. This situation reveals that variable of foreign openness is not among the key determinants of CO_2 emission. These results correspond with the Sharma study (2011). In the short run, the coefficient of error correction term has been found out to be between zero and minus one, and statistically significant. Thereafter, it is shown that the impact of a shock from the independent variables-economic growth, energy consumption, globalization and urbanization variables is improved 72% annually, and in 1.3 year it reaches equilibrium in the long run. For Granger causality test Toda-Yamamoto test is applied. According to the results, between trade openness, pollution, and globalization one-way causality relationship is discovered whereas from environmental pollution towards economic growth and urbanization, from energy consumption and trade openness towards urbanization, from economic growth towards trade openness one-way causality relationship is observed.

According to the results obtained, a number of suggestions could be made to the political decision-makers. First of all, since it is well known that primary energy consumption increases CO_2 emissions at most, environmentally friendly renewable energy sources should be given priority in energy consumption. In this respect, investments directed to hydroelectric plants, nuclear energy plants, solar energy panels, wind turbines have been enhanced in recent years. Especially in industry sector, renewable energy use instead of fossil fuel should be induced, and necessary credits and incentives should be provided. In daily life, measurements should be taken by decreasing the use of fossil fuel and saving energy. For instance, use of public transport instead of personal cars, in order to light up streets, schools, houses, workplaces use of eco-friendly energy sources should be made widespread. Furthermore, certain programs about environmental consciousness at all stages in education could be organized in order to raise awareness. AR-GE activities related to energy efficiency and energy saving should be supported.

As a conclusion, globalization of Turkish economy increases the impact of economic growth, primary energy consumption, trade openness and urbanization which affect environmental pollution positively. Bringing above suggestions into action will change the growing by polluting structure of Turkish economy and help it to become more sensitive to the environment, to turn into an eco-friendly economy, hence to pollute less the environment.

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Etik Beyanı: Bu çalışmanın tüm hazırlanma süreçlerinde etik kurallara uyulduğunu yazar beyan eder. Aksi bir durumun tespiti halinde Fiscaoeconomia Dergisinin hiçbir sorumluluğu olmayıp, tüm sorumluluk çalışmanın yazarına aittir.

Ethics Statement: The author declares that ethical rules are followed in all preparation processes of this study. In case of detection of a contrary situation, Fiscaoeconomia has no responsibility and all responsibility belongs to the author of the study.