THE EFFECT OF INTERNATIONAL TRADE

ON GREEEHOUSE GAS EMISSIONS:

A PANEL DATA ANALYSIS

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THE EFFECT OF INTERNATIONAL TRADE
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DECLARATION OF ORIGINALITY

I, İrem Birol, certify that

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ABSTRACT

The Effect of International Trade on Greenhouse Gas Emissions:

A Panel Data Analysis

There is an increasing and urgent need for a global action in terms of pollutants. Through various conferences, agreements and protocols it became clear that the most immediate danger is coming through GHG emissions and the resulting global climate change. Taking Paris Agreement as a point of origin, this paper aims to provide a summary of the current levels of CO_2 emissions and its linkage to international trade through real GDP per capita, energy consumption, trade openness, share of urban population over the period of years 1992-2014, while testing the EKC hypothesis. From the CCPI 2018 report, a panel of top 20 largest CO_2 emitters are chosen over the years 1992-2014, for a detailed investigation to meet that end. The results show three of the total nine proposed models show over 70% R-squared statistics, supporting the EKC hypothesis.

ÖZET

Uluslararası Ticaretin Sera Gazı Salınımına Etkileri:

Panel Data Analizi

Kirlilik konusunda gittikçe artan ve acil harekete geçme ihtiyacı bulunmaktadır. Çeşitli konferanslar, antlaşmalar ve protokoller sonucunda en yakın tehlikenin sera gazı salınımı ve sonucu olarak küresel iklim değişikliğinden geleceği netleşmiştir. Bu araştırma, Paris Antlaşmasını temel alarak mevcut CO_2 salınımı değerlerini ve uluslararası ticaretin 1992-2014 yılları arasındaki gerçek kişi başı GSYİH, enerji tüketimi, ticaret açıklığı, kentsel nüfus yoğunluğu üzerinden bağlantısını özetlemek ve EKC hipotezini test etmek amacıyla yazılmıştır. CCPI 2018 raporundan en çok CO_2 salınımı yapan yirmi ülkeden oluşan bir panel detaylı araştırma yapmak amacıyla seçilmiştir. Sonuçlar, önerilen dokuz modelden üçünde %70'in üzerinde anlamlı çıkmış ve EKC hipotezinin desteklendiği görülmüştür.

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I would like to thank my mother and my father for their unending and unconditional love and support all my life, and throughout this research, my brother for his comic relief and althogether his rock like persona. I also would like to thank my dear friend Anıl Tabakan for his existence and support, and my dear friend Miray Mor for her pestistant and strengthening emotional support.

I dedicate this thesis to all procrastinators who want to leave positive effects in this world, one step at a time.

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ABBREVIATIONS

Ar	Argon
CCPI	Climate Change Performance Index
CFC	Chlorofluorocarbons
CH_4	Methane
CO	Carbon Monoxide
CO_2 or CO2	Carbon Dioxide
EC	Energy Consumption
FMOLS	Fully Modified Ordinary Least Squares
GDP	Gross Domestic Product
GHG	Greenhouse Gas
H_2O	Water
IOA	Input-Output Analysis
MRIO	Multi-Region Input-Output
N_2O	Nitrous Oxide
O_3	Ozone
PFC	Perfluorocarbons
SF_6	Sulphur Hexafluoride
SRIO	Single-Region Input-Output
TO	Trade Openness
UNEP	United Nations Environment Programme
UP	Urban Population
WTO	World Trade Organization

CHAPTER 1

INTRODUCTION

Today, surrounded with the discussion about 4th Industrial Revolution, we need to look back and understand the effects of the previous revolutions. Klaus Schwab (2017) explains that these industrial revolutions, which started around late 18th century, "marked the transition from muscle power to mechanical power" and proceeds to give a brief history; first industrial revolution marked the start of "mechanical production", the second one paved the way of "mass production", and the third could simply be called "digital revolution".

This ease of increasing production in unprecedented levels in history, led to a proportional increase of the by-products. While a portion of these by-products could be reprocessed, the rest is released back to nature as waste. Over the years of uncontrolled release of these wastes in solid, liquid or gas forms led to accumulation. By 20th century, due to non-existent or lax environmental regulations, insufficient or incorrect inspections that put economic competitiveness ahead of environment, led to the poisoning of humanity's habitat (water, land, air) along with mass extinction of other species co-existing in the same habitat. Unfortunately a part of that damage is irreversible, the other part can be reversed or prevented by taking urgent actions today.

Environment is an inter-disciplinary issue which can be solved by a multitude of experts in various disciplines e.g. scientists, economists, and policy makers working promptly in unison for a sustainable and essentially non-poisonous world for the present and future generations. Any interdisciplinary research in this context, can be seen as a step forward in the right direction.

Currently, climate change as a result of economic and industrial activities can be observed by anyone following the news or old enough to remember the past without any difficulty. Consequently, this thesis is motivated with climate change as point of origin for this research and aims to contribute in the right direction.

In their 1992 report, United Nations Framework Convention on Climate Change describe climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (p. 3). Furthermore, increased economic activity exacerbates climate change considerably via emissions of greenhouse gases into the atmosphere, but particularly via carbon dioxide emissions (Chen and Woodland, 2013). While climate change is one of the effects of these anthropogenic gas emissions, Chen and Woodland (2013), further point out economists’ concern for the climate change’s impact on physical and economic environment, same economic activities created the climate change in the first place. Thus painting the image of the ancient serpent symbol Ouroboros that eats its own tail, consuming itself while feeding.

In order to fight against the anthropogenic GHG emission’s effects, countries came together and signed supra-national agreements and treaties. One of these international agreements is Kyoto Protocol.

UNFCCC sets the framework of Kyoto Protocol as follows:

> The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of “common but differentiated responsibilities”.

Another UNFCCC accord, Paris Agreement, was signed in 2015 for “Recognizing the need for an effective and progressive response to the urgent threat of climate change on the basis of the best available scientific knowledge.” Due to abovementioned urgency felt by the international community, it is being closely monitored by environmental NGOs Germanwatch, Climate Action Network International and NewClimate Institute who came together to monitor the progress of the signing parties, and issued their first report in 2018 named Climate Change Performance Index Results 2018. Since this paper is written to set a benchmark for the control of current agreements and protocols signed by countries in the upcoming years, the countries in this study are chosen from the list of 20 top polluting countries in Climate Change Performance Index Results 2018.

EKC hypothesis has been widely used by economists to test the relationship between emissions and income. While there are 3 groups of study branching out from EKC, this research focuses on a mixed model. This paper is written to summarize the current levels of CO_2 emissions and its linkage to real GDP per capita, energy consumption, trade openness, share of urban population over the period of years 1992-2014, and set a benchmark for the control of current agreements and protocols signed by countries in the upcoming years.

This thesis is organized as follows; second chapter examines literature, third chapter talks about econometric modeling and methodology, fourth chapter focuses on data and results, and finally fifth chapter is reserved for discussion and conclusion.

CHAPTER 2

LITERATURE REVIEW

The literature review chapter is divided into following sections: First, the science behind climate change is briefly explained to provide a comprehensive understanding. Then the relationship of international trade and climate change is studied via various effects, hypotheses, and analysis methods. Finally, the last section reviews the base analysis of this research, namely Environmental Kuznets Curve.

2.1 Science of climate change

In order to provide a complete picture of the effects of international trade on climate change, it is imperative to comprehend the science behind global climate change. According to Stern Review (2007, p. 2) "An overwhelming body of scientific evidence indicates that Earth's climate is rapidly changing, predominantly as a result of increases in greenhouse gases caused by human activities." Kyoto Protocol, signed 1997, lists these anthropogenic greenhouse gases as CO_2, CH_4, N_2O, HFCFs, PFCs, SF_6. The gases are named thusly because the increase of their concentration in the atmosphere amplify the phenomenon called Greenhouse Effect, which is a well-established theory in atmospheric science (Schneider, 1989). As a result of its CO_2 dense atmosphere Venus' surface temperature is near 700 K, whereas with sparse CO_2 levels Mars' temperature is only 220 K; furthermore this huge difference on surface temperatures is directly explained by greenhouse effect (Schneider, 1989).

Contrary to other planets in the solar system, Earth's atmosphere is a mixture of gasses consisting of N_2 (78%), O_2 (21%). Other gases of natural and anthropogenic sources, such as Ar, O_3, H_2O, CO, CO_2, CFCs, etc. take up only 1% of atmosphere. This concentration of gas mixture has acted like a blanket over the planet, and has protected it from the 0 °C freezing temperature of vacuum space, capturing the water vapors, keeping the planet warm and moist enough for life to prosper. This balance has been kept thusly for millennia up until the industrial revolution.

In case of a natural greenhouse effect, the radiation from the Sun reaches the Earth, heats the surface and bounces back into the vacuum of space. However as a result of anthropogenic greenhouse effect; the atmosphere's permeability of light and heat is affected, which causes the radiation incapable of escaping back to space, bouncing back and forth and result in overheating of land, air and water sources (Figure 1). The overall result of this phenomenon is internationally recognized as global climate change.

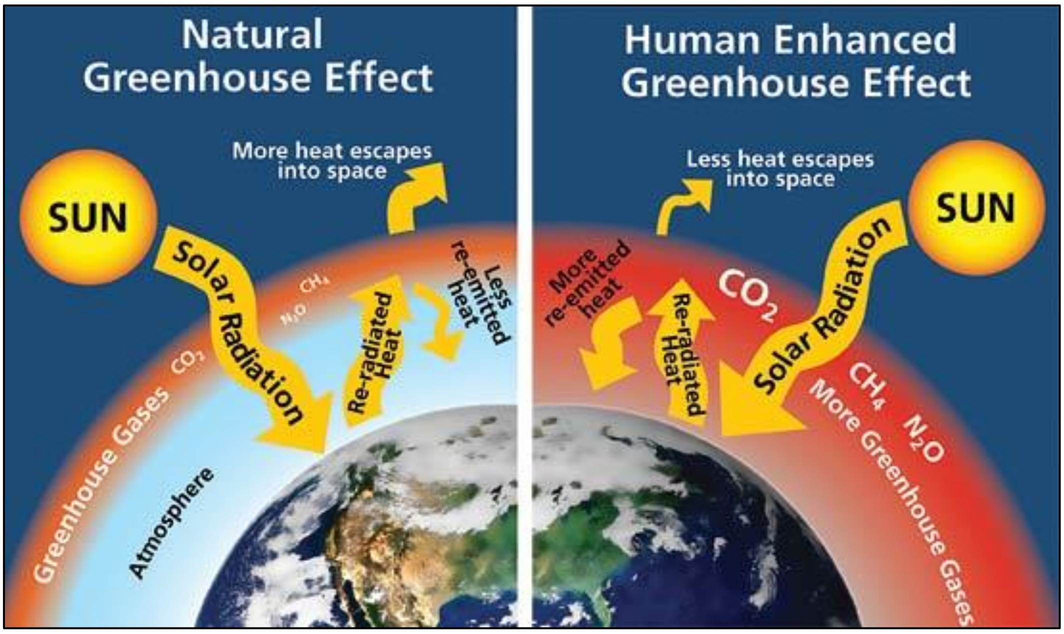


Figure 1. Scheme of natural greenhouse effect and anthropogenic greenhouse effect (climatechange.lta.org, 2019)

In his 2007 report, before providing a detailed scheme of GHG's climate change effects (Figure 2), Stern summarizes "the scale of environment challenge" which can be reduced to below bullet points:

- Climate change is a serious and urgent issue.
- A doubling of pre-industrial levels of greenhouse gases is very likely to commit the Earth to a rise of between 2-5 °C in global mean temperatures.
- Some impacts of climate change itself may amplify warming further by triggering the release of additional greenhouse gases. This creates a real risk of even higher temperature changes.
- Warming is very likely to intensify the water cycle, reinforcing existing patterns of water scarcity and abundance and increasing the risk of droughts and floods.
- As the world warms, the risk of abrupt and large-scale changes in the climate system will rise.
- The body of evidence and the growing quantitative assessment of risks are now sufficient to give clear and strong guidance to economists and policy-makers in shaping a response. (p. 2)

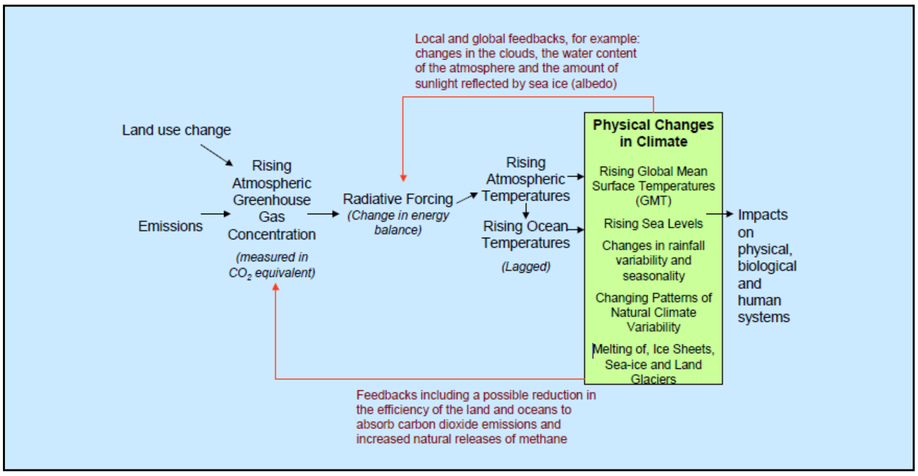


Figure 2. The link between GHG and climate change (Stern Review, 2007, p. 8)

Stern (2007), also suggests that out of total 42 Gt CO_2 equivalent GHG emissions in year 2000, 65% belongs to energy related emissions such as power (24%), transport (14%), industry (14%), buildings (8%), and other (3%); while only 35% of these emissions are non-energy emissions (Figure 3). After more than 10 years since Stern Review was published, the effects of global climate change has already begun. According to Stewart and Elliott's article in 2013, when asked about his notorious report, Stern pointed out that his report was more optimistic than what the increase in global temperatures came to be and conveyed that the risks would be higher than what is in his report.

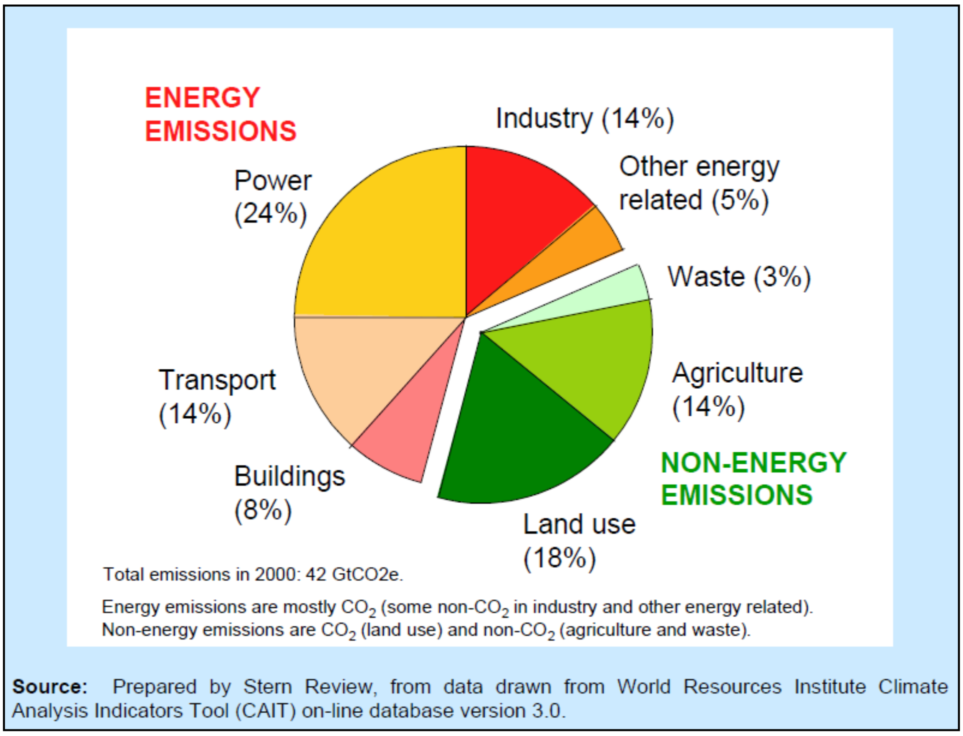


Figure 3. GHG emissions in 2000, by source (Stern, 2007)

2.2 International trade and climate change

The economics of climate change is being researched extensively due to the increasing environmental consciousness. In their book The Economics of Climate Change, Economides, et al. (2018, p. 20) use models that take economy and climate as a coupled system (Figure 2). This is parallel to Chen and Woodland's (2013, p.

382) claim that is about economists concerns on the relations between economic activities and GHG emission and the impacts of climate change on the physical and economic environment.

The economics of climate change is an extensively researched subject matter. Although Stern Review was not the first of its kind, it presents a comprehensive and recognized source for researchers; hence it is not beyond criticism namely by Nordhaus (2007) and Weitzman (2007). In 2008, Garnaut conducted a report focusing on Australian economy, to review the effects of climate change, and eight update papers in 2011. The WTO-UNEP published their report in 2009. The IPCC (Intergovernmental Panel on Climate Change) also provides periodic reports; its 5th Assessment Reports were issued in 2014 and 6th reports are due in 2021-2022.

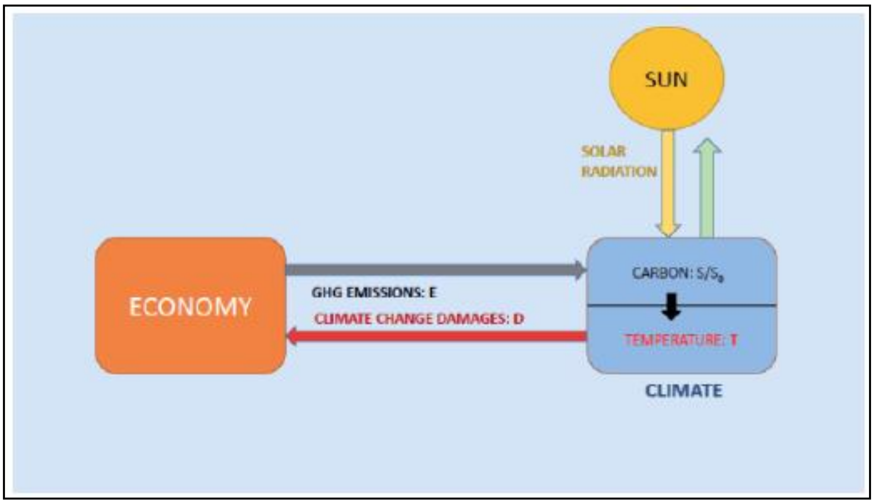


Figure 4. The link between climate and economy (Economides, et al., 2018, p. 20)

After establishing the connection between economic activities and climate change via amplification of GHG emissions, it is prudent to divide the effects of international trade into direct effects and indirect effects.

Arguably the most obvious effect of international trade on GHG emissions is the direct effect. The reasoning behind is that international trade requires transportation,

transportation requires energy and “95 percent of the total energy used by world transport” (WTO-UNEP Report, 2009, p. 60) is generated via burning fossil fuels. By-products of fossil fuels are GHG emissions including but not limited to CO_2, CO, N_xO, SO_x. WTO-UNEP Report (2009 pp. 58-59) express that most of the time, the traded goods are transported with multiple modes of transportation, the very least at the final step to reach the end user almost always requires an inland transportation method which represents 15.9 percent of trade transport by volume. Cristea et al. (2013) paints a general picture stating that “World-wide, 33 percent of trade-related emissions come from international transport,…in the manufacturing sectors: 80 percent of trade-related emissions in machinery exports come from international transportation.”

According to Chen & Woodland (2013), economists’ interest in indirect effects of international trade has been greater and that the impacts of trade are frequently identified through three major effects which are scale, composition and technique effects. Grossman and Krueger (1993) were the first to classify these three effects, followed by Copeland and Taylor (1994, 1995) who proposed a formal model to their research. Later, these effects have been analyzed from empirical perspectives (Antweiler et al, 2001; Ederington et al. 2004; Frankel and Rose 2005).

The composition effect is defined to be measuring emissions in relation with a country’s industrial composition especially after trade liberalization (Ausland, 2008, p. 7). As a result of trade liberalization, if an economy increases the exportation of pollution-intensive products and the importation of clean products then the emissions is expected to increase as well (Chen and Woodland, 2013).

Technique effect is related to the change in production or consumption techniques through environmental policy changes or changes in technology itself

(Ausland, 2008). Chen and Woodland (2013) point out to the advancement on pollution abatement technologies' potential resulting in a drop in contaminated products.

Lastly, scale effect discusses that due to the alterations in tariffs, the economic activities would be affected and thereby changing the pollutions levels (Chen and Woodland, 2013).

2.3 Emissions embodied in trade

The role of international trade on creation of GHG emissions and as an extension climate change is a complex issue that cannot be approached by a single viewpoint. For that we also need to understand how the emissions embodied in trade are calculated as well as comprehend concepts like Pollution Haven Hypothesis. As Peters and Hertwich (2008, p.1402) explain, emissions are either related the production processes or the global supply chain which adds to the overuse of electricity, transportation, manufacturing, and so on. The trade of these products results in what is became to be known as emissions embodied in trade and the most frequently accepted method for their analysis is MRIO.

2.3.1 Pollution haven hypothesis (PHH)

Trade liberalization resulted in countries' specialization on certain goods' production. While technology and factor endowments are part of what affects the nature of those goods, taxes and regulations in a specific country can be considered the other part. When talking about international trade's contribution to the GHG emissions, the nature of those taxes and regulations is surely an environmental one. According to Chen and Woodland (2013), countries with lax environmental policies will be specialized in the production and exportation of pollution-intensive goods, creating a Pollution Haven for countries with strict environmental policies.

There has been many studies researching Pollution Haven Hypothesis over the years, Pethig (1976) modelled pollution as a by-product of production, suggesting two-good one-factor framework, which is similar to Heckscher-Ohlin Model and this model supports Pollution Haven Hypothesis (Chen and Woodland, 2013). Levinson & Taylor's (2008) model investigated trade between two countries and found that the industries are separated into two groups; while the country with the lowest emission tax rate specialises in pollution-intensive industries, cleanest industries shifted towards high emission tax rate country, thus supporting PHH. Chen and Woodland (2013) use Copeland and Taylor's (1995) two country model of endogenous environmental policies to result that when factor price equalisation is not the achieved at the equilibrium, and if one of the trade partners follows easy environmental regulations and the other one following tight policies produces the cleanest goods, then global trade emissions may stay the same.

2.3.2 Input-output analyses (IOA)

In order to assess emissions embodied in international trade of various countries and regions, input-output methods were proposed for a thorough carbon footprint calculations at national and supra-national levels (Wiedmann, 2009). Machado, et al. (2001) state that by using IO models combining economics, energy and environmental areas, it is possible to track down the direct and indirect effects of change in energy/environmental nexus in an economy. These environmentally extended input-output approaches can be divided into single-region input-output (SRIO) and multi-region input-output (MRIO) analyses.

The SRIO is usually used to calculate GHG emissions and further environmental effects of final demand in a national economy to figure out the consumption footprints; however it doesn’t differentiate between domestic and foreign production methods (Wiedmann, 2009). Therefore the MRIO is often accepted as a more comprehensive method. MRIO approach is capable of quantifying interdependencies between non-native sectors that adopted various production techniques, resource consumption and pollution intensities and actually bring better results with more countries and sectors utilized in the model (Wiedmann, 2009).

This model is best when assessing each sector’s contribution to GHG emissions to same sectors. It is suited to a more detailed and by sector analysis, therefore not suited to the purpose of this paper.

2.4 Environmental Kuznets Curve (EKC)

In 1955 Simon Kuznets conducted a series of researches and found an inverted U shape relation between economic development and inequality in income distribution. This inverted U shape was later named as Kuznets Curve. In 1991, Grossman and Krueger found a similar connection between income and carbon emissions, thus opening up a new research branch and proposing Environmental Kuznets Curve hypothesis. EKC hypothesis states that with the increase in income the carbon emissions would also increase up to a threshold point, and then starts decreasing, thus creating the famed inverted U-shape (Figure 5).

There are three groups of study germinating from EKC. The first group focuses on the basic EKC hypothesis and investigates whether the relationship between income and emissions results in EKC. Kasman and Duman (2015) names a few studies in their research: Agras and Chapman, 1999; Coondoo and Dinda, 2002; Dinda and Coondoo, 2006; Akbostanci, et al., 2009; Gaelotti et al., 2009; Lee and Lee, 2009.

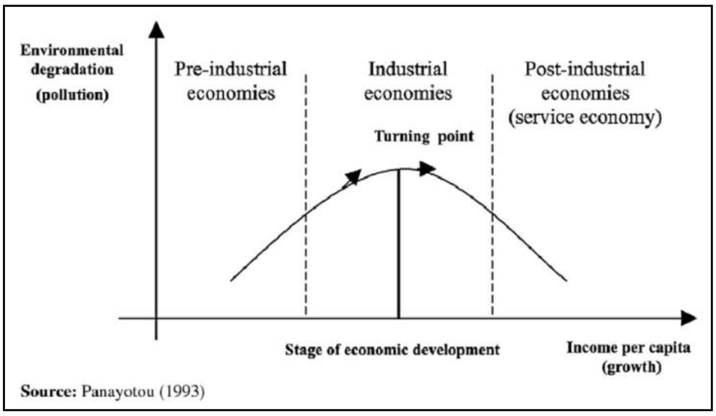


Figure 5. Environmental Kuznets Curve

The second group investigates the link between income and energy consumption, since a large portion of consumed energy is produced by burning fossil fuels and generating CO_2 emissions. Ozcan (2013) provides a few example studies in this branch: Gurgul and Lach, 2011, 2012; Altinay and Karagol, 2004; Al-Iriani, 2006; Apergis and Payne, 2009b; Narayan and Smith, 2008; Oh and Lee, 2004; Soytas and Sari, 2003, 2006; Stern, 2000; Yang, 2000.

The third group of study fuses the first two, and suggests a relationship between income, emissions and energy consumption. While there are a lot of papers researching the same for single countries (Ang, 2007; Soytas, et al., 2007, Halicioglu, 2009), there are some that researched utilizing cross-country data (Sari and Soytas, 2009; Ozcan, 2013; Kasman and Duman, 2015). Utilizing this third approach, the goal of this thesis is to summarize the current levels of CO_2 emissions and its linkage to real GDP per capita, energy consumption, trade openness, share of urban population over the period of years 1992-2014, and set a benchmark for the control of current agreements and protocols signed by countries in the upcoming years.

CHAPTER 3

ECONOMETRIC MODELLING AND METHODOLOGY

3.1 Econometric modelling

In order to investigate the relationship between emissions, income, energy consumption, trade openness and share of urban population, a similar model is used as in Kasman and Duman's (2015) research. Note that GHG emissions and CO_2 emissions are used interchangeably throughout this thesis for simplicity, since CO_2 emissions constitute almost 70% of global GHG emissions (Peters and Hertwich, 2008).

Starting from below basic formula,

$$CO_{2it} = \alpha + \beta_1 GDP_{it} + \beta_2 GDP_{it}^2 + \beta_3 EC_{it} + \varepsilon_{it} \quad (1)$$

In which, all variables are in natural logarithm, i and t denotes country and time respectively, CO2 is the carbon dioxide emissions in metric tons per capita, GDP is the real GDP per capita and GDP^2 is the squared result of the same, EC is the energy consumption per capita. β_1, β_2 and, β_3 coefficients denote the long-run elasticities of CO_2 emissions of their respective variables, and also adding trade openness, TO, and share of urban population, UP, this thesis proposes 9 models given in equations from (2) to (10) to investigate respective long-run elasticities in line with Kasman and Duman's (2015).

Model 1:

$$CO_{2it} = \alpha + \beta_1 GDP_{it} + \beta_2 GDP_{it}^2 + \beta_3 EC_{it} + \varepsilon_{it} \quad (2)$$

Model 2:

$$CO_{2it} = \alpha + \beta_1 GDP_{it} + \beta_2 GDP_{it}^2 + \beta_3 UP_{it} + \varepsilon_{it} \quad (3)$$

Model 3:

$$CO_{2it} = \alpha + \beta_1 EC_{it} + \beta_2 TO_{it} + \varepsilon_{it} \quad (4)$$

Model 4:

$$CO_{2it} = \alpha + \beta_1 EC_{it} + \beta_2 UP_{it} + \varepsilon_{it} \quad (5)$$

Model 5:

$$CO_{2it} = \alpha + \beta_1 GDP + \beta_2 GDP_{it}^2 + \beta_3 EC_{it} + \beta_4 UP_{it} + \varepsilon_{it} \quad (6)$$

Model 6:

$$CO_{2it} = \alpha + \beta_1 GDP + \beta_2 GDP_{it}^2 + \beta_3 TO_{it} + \beta_4 UP_{it} + \varepsilon_{it} \quad (7)$$

Model 7:

$$CO_{2it} = \alpha + \beta_1 GDP + \beta_2 GDP_{it}^2 + \beta_3 EC_{it} + \beta_4 TO_{it} + \beta_5 UP_{it} + \varepsilon_{it} \quad (8)$$

Model 8:

$$CO_{2it} = \alpha + \beta_1 GDP_{it} + \beta_2 GDP_{it}^2 + \beta_3 TO_{it} + \varepsilon_{it} \quad (9)$$

Model 9:

$$CO_{2it} = \alpha + \beta_1 GDP + \beta_2 GDP_{it}^2 + \beta_3 EC_{it} + \beta_4 TO_{it} + \varepsilon_{it} \quad (10)$$

3.2 Methodology

Following procedures has been conducted in order to test the relationship between carbon dioxide emissions, energy consumption, income, trade openness, and urbanization. First, panel unit root tests are performed to check for stationarity of the time series variables. Once non-stationarity is confirmed, panel cointegration tests were conducted to question the cointegration relationship between the series. After finding the variables' cointegration, fully modified OLS method (FMOLS) is conducted to estimate long-run elasticities. EViews 10 Student Lite version was used to conduct abovementioned tests.

3.2.1 Panel unit root tests

From a theoretical point of view, Panel Unit Root Tests are multiple-series root tests that have been used on panel data structures. Levin, Lin and Chu (2002), Breitung (2000) tests assume a common unit root process which makes ρ_i identical across cross-sections and under the null hypothesis, both tests suggest there is unit root (EViews 10 User's Guide II).

Second set of tests suggested by Im, Pesaran and Shin (2003), and ADF and PP tests, suggested by Maddala and Wu (1999) and Choi (2001), take individual unit root processes into consideration, so it may vary across cross-sections. These tests combine the individual unit root tests to derive a panel specific result (EViews 10 User's Guide II).

3.2.1.1 Levin, Lin and Chu test

Levin, Lin, and Chu (2002) start with a basic ADF equation where α = ρ – 1 and lag order for the difference terms p_i to vary across cross-sections (EViews 10 User's Guide II).

$$\Delta y_{it-1} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij}\, \Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it} \tag{11}$$

Null hypothesis assumes that there is unit root $H_0: \alpha = 0$; while alternative hypothesis suggests there is no unit root and the panel series is stationary $H_1: \alpha < 0$. LLC suggest that under null hypothesis, a modified t-statistic for the coefficient $\hat{\alpha}$ is asymptomatically normally distributed (EViews 10 User's Guide II).

$$t_\alpha^* = \frac{t_\alpha - (N\tilde{T}) S_N \hat{\sigma}^{-2} se(\hat{\alpha}) \mu_{mT^*}}{\sigma_{mT^*}} \longrightarrow N(0,1) \tag{12}$$

Where;

- t_α is the standard t-statsitic for $\hat{\alpha}$ = 0,
- $\hat{\sigma}^{-2}$ is the estimated variance of the error term η,
- $se(\hat{\alpha})$ is the standard error of $\hat{\alpha}$,
- S_N mean of the ratios of the long-run standard deviation to the innovation standard deviation for each individual,
- $\mu_{mT}{}^{*}$ *and* $\sigma_{mT}{}^{*}$ are adjustment terms for the mean and standard deviation (EViews 10 User's Guide II).

3.2.1.2 Breitung test

Similar to Levin, Lin, and Chu (2002), Breitung also starts with a basic ADF equation but uses the exogenous components and leaves out the autoregressive part, transforms and detrends when formulating the standardized proxies (EViews 10 User's Guide II).

$$\Delta y_{it-1} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij}\, \Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it} \tag{13}$$

$$\Delta y_{it}{}^{*} = \sqrt{\frac{(T-t)}{(T-t+1)}}(\Delta \tilde{y}_{it} - \frac{\Delta \tilde{y}_{it+1} + \cdots + \Delta \tilde{y}_{iT}}{T-t} \tag{14}$$

$$y_{it}{}^{*} = \tilde{y}_{it} - \tilde{y}_{i1} - \frac{t-1}{T-1}(\tilde{y}_{iT} - \tilde{y}_{i1}) \tag{15}$$

Persistence parameter α is estimated from below equation and under null hypothesis the resulting estimator α^{*} is asymptomatically distributed as a standard normal. (EViews 10 User's Guide II).

$$\Delta y_{it}{}^{*} = \alpha y_{it-1}{}^{*} + \nu_{it} \tag{16}$$

3.2.1.3 Im, Pesaran, Shin test

Im, Pesaran and Shin identify discrete ADF regression for each cross section.

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij}\, y_{it-j} + X'_{it}\delta + \varepsilon_{it} \tag{17}$$

Where;

H_0: α = 0; for all i,

$$H_1: \begin{cases} \alpha i = 0 & \text{for } i = 1, 2, \ldots, N_1 \\ \alpha i < 0 & \text{for } i = N+1, N+2, \ldots, N \end{cases}$$

In general case, properly standardized test statistics, $\overline{t_{NT}}$ has an asymptomatic standard normal distribution (EViews 10 User's Guide II):

$$W_{\overline{t_{NT}}} = \frac{\sqrt{N}\left(\overline{t_{NT}} - N^{-1}\sum_{i=1}^{N} E\left(\overline{t_{iT}}(p_i)\right)\right)}{\sqrt{N^{-1}\sum_{i=1}^{N} Var\left(\overline{t_{iT}}(p_i)\right)}} \rightarrow N(0,1) \tag{18}$$

3.2.1.4 ADF-Fisher and PP-Fisher tests

Maddala and Wu (1999), and Choi (2001) suggested tests that combine the p-values from individual unit root tests using Fisher's (1932) results. If π_i is the p-value of cross-section i from any individual unit root test, the asymptomatic result for all N under null, would be;

$$-2\sum_{i=1}^{N} \log(\pi_i) \rightarrow \chi^2_{2N} \tag{19}$$

Furthermore Choi shows below equation where Φ^{-1} is the inverse of the standard normal cumulative distribution function (EViews 10 User's Guide II).

$$Z = \frac{1}{\sqrt{N}}\sum_{i=1}^{N} \Phi^{-1}(\pi_i) \rightarrow N(0,1) \tag{20}$$

3.2.2 Pedroni (Engle-Granger based) panel cointegration test

Engle-Granger (1987) cointegration test suggests if there is cointegration, the residuals are expected to be I(0), otherwise there's no cointegration and the residuals would be I(1). Pedroni (1999, 2004) expanded Engle-Granger structure to work with panel data (EViews 10 User's Guide II).

Starting with below regression where y and x should be under the assumption of I(1). For t = 1, …, T; i = 1, …, N; m = 1, …, M

$$y_{it} = \alpha_i + \delta_i t + \beta_{1i} x_{1i,t} + \beta_{2i} x_{2i,t} + \cdots + \beta_{Mi} x_{Mi,t} + e_{i,t} \quad (21)$$

Where null hypothesis suggests no cointegration, the residuals $e_{i,t}$ will be I(1). Once the residuals are obtained from above equation, one of two auxiliary regressions below is performed for each cross-section to test whether residuals are I(1) (EViews 10 User's Guide II).

$$e_{it} = \rho_i e_{it-1} + u_{it} \quad (21)$$

Or

$$e_{it} = \rho_i e_{it-1} + \sum_{j=1}^{p_i} \psi_{ij} \Delta\, e_{it-1} + v_{it} \quad (22)$$

The standardized statistic is asymptomatically distributed

$$\frac{\aleph_{N,T} - \mu\sqrt{N}}{\sqrt{\upsilon}} \Rightarrow N(0,1) \quad (23)$$

3.2.3 Panel FMOLS estimates

Engle and Granger (1987) suggest that when the linear cointegration of two or more I(1) series are stationary, or I(0), the series are cointegrated. This type of linear combination determine a cointegrating equation with cointegrating vector of weights distinguishing the long-run relationship between the variables (EViews 10 User's Guide II).

Starting from below equation

$$y_t = X_t'\beta + D_{1t}{}' + u_{1t} \tag{24}$$

By suggesting an estimator which uses a semi-parametric correction, Phillips and Hansen (1990), remove the difficulties originated from the long correlation between the cointegrating equation and stochastic regressors innovations. Consequenting Fully Modified OLS (FMOLS) estimator is asymptomatically unbiased and has fully efficient mixture normal asymptotic permitting for standard Wald tests utilising asymptomatic Chi-square statistical inference (EViews 10 User's Guide II).

FMOLS estimator is specified by below equation where; $Z_t = (X_t' \, , D_t')'$.

$$\hat{\theta} = \begin{bmatrix} \hat{\beta} \\ \hat{\gamma}_1 \end{bmatrix} = (\sum_{t=2}^{T} Z_t Z_t{}')^{-1} \left(\sum_{t=2}^{T} Z_t y_t{}^{+} - T \begin{bmatrix} \hat{\lambda}_{12}^{+}{}' \\ 0 \end{bmatrix} \right) \tag{25}$$

CHAPTER 4

DATA AND RESULTS

4.1 Data

Kyoto Protocol signed 1997, and Paris Agreement signed 2006, were the result of the United Nations Climate Change Conference (UNFCCC) held in 1992. While Kyoto Protocol came into effect in 2005 and extended by Doha Amendment until 2020; this paper focuses on Paris Agreement. According to UNFCCC announcement, by 2016 175 Parties (174 states and European Union) have provided their signatures. Paris Agreement is especially important since it is unprecedented to secure climate action in international law setting where it "aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty" (Paris Agreement, 2016, p.3).

Due to the increasing urgency in climate matters, there are many reports mostly formed by NGOs tracking countries' progress. Climate Action Tracker, being one of those reports, suggests that by June 2019 there are no role model countries in the world well below 1.5 ^{o}C levels, and only two countries namely Morocco and Gambia that are Paris Agreement compatible below 1.5 ^{o}C levels; while the rest of the world range between 2 ^{o}C to 4 ^{o}C+. The Climate Change Performance Index is another report focused on comparing and measuring the countries' progress levels in accordance with Paris Agreement, additionally provides annual reports since 2016 to that end. CCPI is composed of 4 categories where climate policy is determined by two indicators and other three categories namely energy use, renewable energy and GHG emissions are determined by four indicators each (Figure 6).

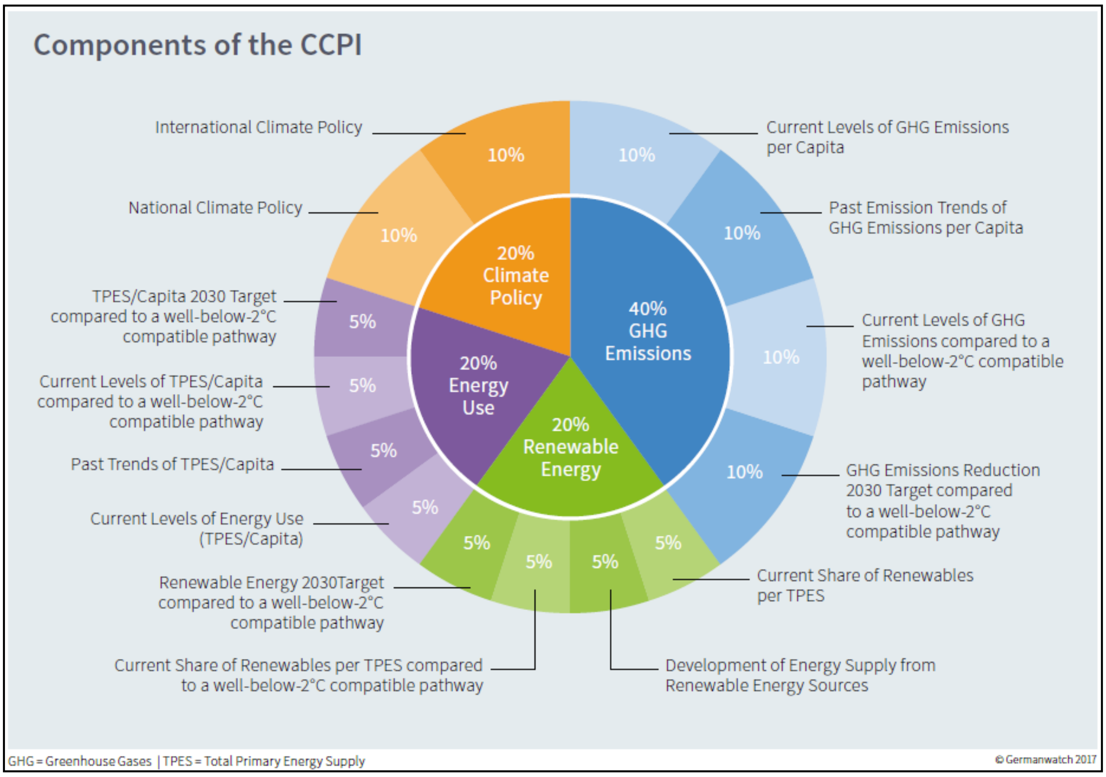
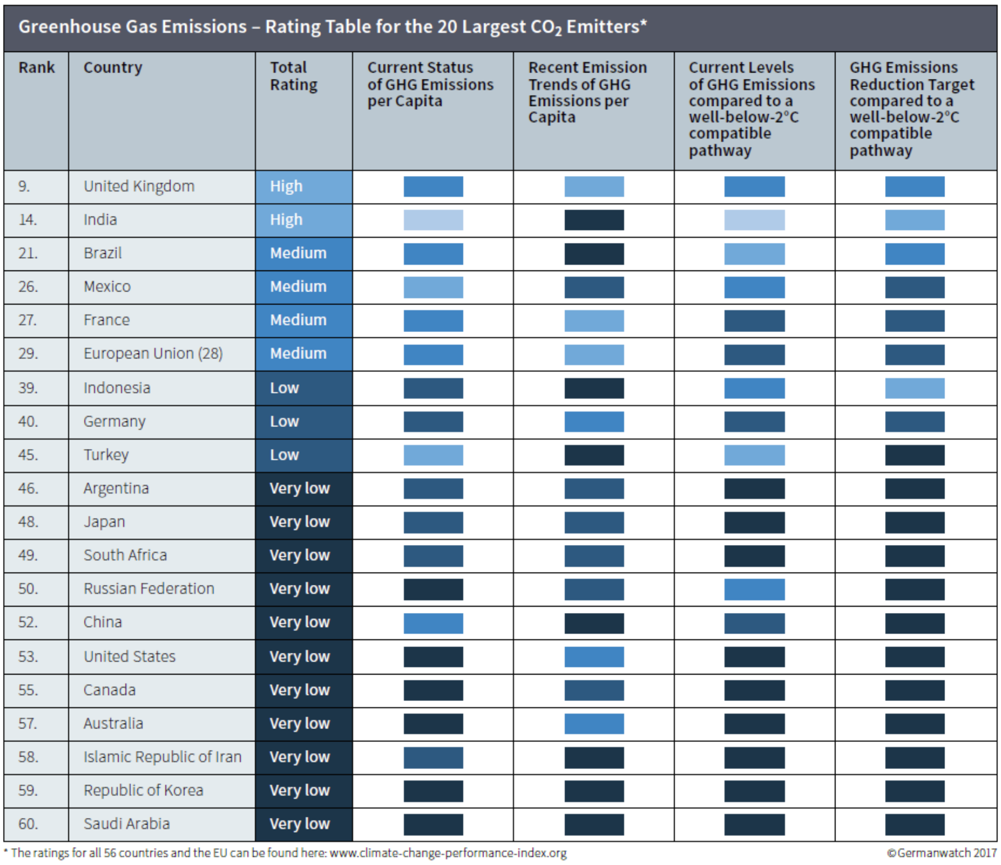


Figure 6. Components of the CCPI (CCPI 2018)

Sampled countries used in this research were chosen from the top 20 largest CO_2 emitters per CCPI 2018. From the largest emitter to smallest they are: United Kingdom, India, Brazil, Mexico, France, European Union (28), Indonesia, Germany, Turkey, Argentina, Japan, South Africa, Russian Federation, China, United States, Canada, Australia, Islamic Republic of Iran, Republic of Korea and Saudi Arabia (Figure 7). Data for all 20 countries were extracted from World Bank, taking five variables into account; per capita CO_2 emissions in metric tons (mt), real per capita GDP in constant 2010 US$, per capita total energy consumption in kilogram of oil equivalent (kgoe), trade openness, and share of urban population over the period 1992-2014. This data set is in accordance with similar researches such as Sari and Soytas (2009), Ozcan (2013), Kasman and Duman (2015). Panel data for all 20 countries is listed in Appendix.



Greenhouse Gas Emissions – Rating Table for the 20 Largest CO_2 Emitters*						
Rank	Country	Total Rating	Current Status of GHG Emissions per Capita	Recent Emission Trends of GHG Emissions per Capita	Current Levels of GHG Emissions compared to a well-below-2°C compatible pathway	GHG Emissions Reduction Target compared to a well-below-2°C compatible pathway
9.	United Kingdom	High				
14.	India	High				
21.	Brazil	Medium				
26.	Mexico	Medium				
27.	France	Medium				
29.	European Union (28)	Medium				
39.	Indonesia	Low				
40.	Germany	Low				
45.	Turkey	Low				
46.	Argentina	Very low				
48.	Japan	Very low				
49.	South Africa	Very low				
50.	Russian Federation	Very low				
52.	China	Very low				
53.	United States	Very low				
55.	Canada	Very low				
57.	Australia	Very low				
58.	Islamic Republic of Iran	Very low				
59.	Republic of Korea	Very low				
60.	Saudi Arabia	Very low				

* The ratings for all 56 countries and the EU can be found here: www.climate-change-performance-index.org ©Germanwatch 2017

Figure 7. 20 Largest CO_2 Emitters (CCPI 2018)

Table 1 presents mean value and standard deviation, summary statistics of variables CO_2 emissions (CO2), energy consumption (EC), real per capita GDP (GDP), trade openness (TO), and share of urban population (UP); where trade openness is the ratio of trade volume to GDP, and share of urban population is the ratio of urban population to total population. The spectrum of mean CO_2 emission vary from smallest 1.121 in India to largest 18.754 in United States. Considering the mean per capita energy consumption, with 463.620 India has the lowest energy consumption while Canada has the highest with 8,008.350. As for the mean per capita real GDP, Australia is the richest country with 46,026.680 whereas India having 1,010.698, is the poorest in the panel. In terms of mean trade openness, United Kingdom has the highest ratio, in contrast Brazil has the lowest. Lastly, Argentina has the highest share urban population, while India has the lowest in 20 countries.

Table 1. Summary Statistics of Time Series Variables

Country	Stats	CO2	EC	GDP	TO	UP
Argentina	Mean	4.047	1,716.307	8,760.559	29.601	89.608
	Std Dev	0.453	173.654	1,245.785	9.308	1.194
Australia	Mean	16.846	5,524.617	46,026.680	40.204	84.831
	Std Dev	0.879	260.208	6,258.375	2.986	0.438
Brazil	Mean	1.899	1,160.099	9,595.435	23.039	81.518
	Std Dev	0.295	162.617	1,326.311	4.221	3.032
Canada	Mean	16.270	8,008.350	43,951.010	68.021	79.568
	Std Dev	0.825	234.851	4,894.149	0.737	1.393
China	Mean	4.346	1,328.759	2,809.470	44.888	40.388
	Std Dev	1.918	528.323	1,637.224	10.749	8.271
Germany	Mean	9.938	4,061.200	38,951.010	64.347	75.508
	Std Dev	0.651	133.418	3,602.577	15.725	1.298
European Union	Mean	7.820	3,432.228	30,893.670	67.582	72.571
	Std Dev	0.569	144.639	3,368.560	10.208	1.321
France	Mean	5.779	4,055.559	38,373.960	51.895	76.713
	Std Dev	0.463	175.243	3,072.873	6.213	1.578
United Kingdom	Mean	8.622	3,521.665	36,332.000	79.741	52.913
	Std Dev	0.902	328.746	4,217.424	1.412	4.648
Indonesia	Mean	1.527	751.880	2,574.882	57.287	43.716
	Std Dev	0.408	89.080	534.006	10.893	6.130
India	Mean	1.121	463.620	1,010.698	35.699	28.817
	Std Dev	0.287	85.000	320.265	13.449	2.002
Iran, Islamic Rep.	Mean	6.178	2,207.836	5,394.100	43.732	65.861
	Std Dev	1.446	524.703	764.109	6.876	4.674
Japan	Mean	9.452	3,868.684	42,925.060	24.272	83.852
	Std Dev	0.305	197.535	2,228.815	6.759	5.552
Korea, Rep.	Mean	9.627	4,139.559	17,158.830	73.756	80.132
	Std Dev	1.467	814.832	4,593.096	20.167	1.832
Mexico	Mean	3.988	1,522.696	8,772.092	52.342	75.687
	Std Dev	0.221	69.453	570.880	10.335	2.057
Russian Federation	Mean	11.484	4,594.582	8,431.257	57.154	73.503
	Std Dev	0.953	384.886	2,261.829	13.616	0.187
Saudi Arabia	Mean	15.725	5,341.103	19,123.810	74.683	80.497
	Std Dev	2.660	869.131	1,152.231	11.760	1.549
Turkey	Mean	3.539	1,258.147	9,280.142	45.853	66.694
	Std Dev	0.569	199.099	1,926.797	5.951	3.933
United States	Mean	18.754	7,586.498	45,214.740	25.056	79.282
	Std Dev	1.256	375.450	4,665.487	3.512	1.597
South Africa	Mean	8.684	2,547.268	6,407.076	53.470	58.557
	Std Dev	0.608	172.129	806.234	9.052	3.502
Panel Data	Mean	8.282	3,354.533	21,099.320	49.290	70.852
	Std Dev	5.310	2,132.417	16,780.110	18.618	16.085

4.2 Results

4.2.1 Panel unit root tests

Panel Unit Roots tests were conducted to check stationarity of the panel data, where all variables are taken in natural logarithms, with two different criteria. First one taking only individual intercept into consideration, results can be found in Table 2. The results of LLC tests show that only lnCO2, and lnEC are non-stationary at level and stationary at 1st difference; while lnGDP, lnGDP2, lnTO and lnUP are stationary at level and at 1st difference. In IPS and ADF-Fisher tests lnCO2, lnEC, lnGDP, lnGDP2, lnTO all result stationarity at 1st difference, while lnUP is stationary in level and non-stationary in 1st difference in IPS test and stationarity at level and 1st difference in ADF-Fisher test. In PP-Fisher test, at level lnGDP, lnGDP2, and lnUP are stationary, and in 1st difference all except lnUP show stationarity. In Breitung test, lnCO2, lnEC, lnGDP, lnGDP2 are stationary in 1st difference only, while lnTO is stationary in both level and 1st difference and lnUP is non-stationary in both.

The second set of panel unit root tests used individual intercept and individual trend, results are shown in Table 3. This time lnCO2 provided the desired results of non-stationarity at level and stationarity at 1st difference in LLC, IPS, and Breitung tests; lnEC provided the same in IPS, ADF-Fisher and Breitung tests; lnGDP, lnGDP2, and lnUP results were all non-stationary at level and stationary at 1st difference while lnTO results show stationarity at both level and 1st difference.

The results of panel unit root tests show provide appropriate conditions in line with the results of Ozcan (2013) and Kasman and Duman (2015); allowing to proceed with panel cointegration tests.

Table 2. Panel Unit Root Tests (Individual Intercept)

Test			lnCO2	lnEC	lnGDP	lnGDP2	lnTO	lnUP
Levin Lin & Chu t	level	Stat	0.8000	1.1566	-2.1901	-2.1901	-3.3798	-13.5906
		Prob	0.7881	0.8763	0.0143	0.0143	0.0004	0.0000
	1st diff	Stat	-12.4170	-11.6883	-12.7716	-12.7716	-16.0238	-1.9717
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0243
Im, Pesaran and Shin W-stat	level	Stat	3.6437	3.6671	1.8713	1.8713	-1.3298	-2.8046
		Prob	0.9999	0.9999	0.9693	0.9693	0.0918	0.0025
	1st diff	Stat	-13.0255	-12.1188	-10.8169	-10.8169	-16.3671	-0.1122
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.4554
ADF - Fisher Chi-square	level	Stat	26.3620	23.9984	38.0589	38.0589	50.7494	147.3860
		Prob	0.9522	0.9787	0.5579	0.5579	0.1187	0.0000
	1st diff	Stat	230.7350	216.3290	183.2170	183.2170	281.8890	60.1903
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0210
PP - Fisher Chi-square	level	Stat	27.5380	40.0404	56.7676	56.7676	51.5045	458.0820
		Prob	0.9325	0.4685	0.0414	0.0414	0.1051	0.0000
	1st diff	Stat	299.2400	327.6530	209.7340	209.7340	323.6700	44.6991
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.2809
Breitung t-stat	level	Stat	3.9771	3.1157	1.7873	1.7873	-1.6888	4.4188
		Prob	1.0000	0.9991	0.9631	0.9631	0.0456	1.0000
	1st diff	Stat	-6.0975	-8.1462	-5.0946	-5.0946	-8.3170	-1.2789
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.1005

Table 3. Panel Unit Root Tests (Individual Intercept and Individual Trend)

Test			lnCO2	lnEC	lnGDP	lnGDP2	lnTO	lnUP
Levin Lin & Chu t	level	Stat	-1.4212	-2.5038	-0.9343	-0.9343	-2.8924	-1.0395
		Prob	0.0776	0.0061	0.1751	0.1751	0.0019	0.1493
	1st diff	Stat	-9.9684	-10.7058	-9.4674	-9.4674	-11.9025	-19.1042
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Im, Pesaran and Shin W-stat	level	Stat	0.0429	-0.1145	0.5516	0.5516	-4.1823	2.4380
		Prob	0.5171	0.4544	0.7094	0.7094	0.0000	0.9926
	1st diff	Stat	-11.8467	-13.4098	-8.4395	-8.4395	-13.0809	-7.7344
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ADF - Fisher Chi-square	level	Stat	63.9551	51.8657	40.7237	40.7237	86.5813	42.5739
		Prob	0.0094	0.0990	0.4384	0.4384	0.0000	0.3609
	1st diff	Stat	193.9990	218.1270	145.9840	145.9840	208.3910	306.5700
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PP - Fisher Chi-square	level	Stat	58.0637	64.1204	27.3522	27.3522	62.7321	39.8805
		Prob	0.0322	0.0091	0.9360	0.9360	0.0123	0.4756
	1st diff	Stat	318.6590	676.4230	217.5460	217.5460	302.8160	274.8990
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Breitung t-stat	level	Stat	3.9771	3.1157	1.7873	1.7873	-1.6888	4.4188
		Prob	1.0000	0.9991	0.9631	0.9631	0.0456	1.0000
	1st diff	Stat	-6.0975	-8.1465	-5.0946	-5.0946	-8.3170	-1.2789
		Prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.1005

4.2.2 Panel cointegration tests

Overall nine models were tested with cointegration test suggested by Pedroni. The models are shown in Table 4. The null hypothesis of Pedroni's residual cointegration test state that there's no cointegration between variables. All tests are conducted with natural logarithm of the variables. Lag length is calculated automatically by selecting Schwarz Info Criterion.

Table 4. List of Models and Their Corresponding Variables

	Variables
Model 1	CO2, GDP, EC
Model 2	CO2, GDP, UP
Model 3	CO2, EC, TO
Model 4	CO2, EC, UP
Model 5	CO2, GDP, EC, UP
Model 6	CO2, GDP, TO, UP
Model 7	CO2, GDP, EC, TO, UP
Model 8	CO2, GDP, TO
Model 9	CO2, GDP, EC, TO

Models 1 through 7 provided statistically significant results indicating that the variables are cointegrated. Model 8 and Model 9 failed to provide statistically significant results and henceforth excluded. Models 1 through 4 are significant using deterministic trend assumption individual intercept while Model 5 and 7 are significant with the assumption that there's no deterministic intercept or trend. Model 6 showed significance with individual intercept and individual trend.

Model 1 and Model 3 showed five observations each, providing statistical significance at 1% level, indicating that the variables in respective models are panel cointegrated. Variables in Model 2, Model 4, Model 5, Model 6 and Model 7 also demonstrate panel cointegration among variables with four observations each.

Table 5. Panel Cointegration Tests

Test	Within Dimension	Stat	Prob	Weighted Stat	Prob	Between Dimension	Stat	Prob
Pedroni	Panel v- stat	3.2231	0.0006	1.1581	0.1234			
(individual intercept)	Panel rho-stat	-0.2539	0.3998	-2.6787	0.0037	Group rho-stat	-0.1456	0.4421
Model 1 (CO2, GDP, EC)	Panel PP stat	-2.0506	0.0202	-6.3928	0.0000	Group PP-stat	-5.1397	0.0000
	Panel ADF stat	-4.1074	0.0000	-7.4254	0.0000	Group ADF-stat	-5.1397	0.0000
Pedroni	Panel v- stat	1.3484	0.0888	0.8424	0.1998			
(individual intercept)	Panel rho-stat	-0.1355	0.4461	-0.6053	0.2725	Group rho-stat	0.8514	0.8027
Model 2 (CO2, GDP, UP)	Panel PP stat	-1.8236	0.0341	-2.2504	0.0122	Group PP-stat	-1.7874	0.0369
	Panel ADF stat	-3.5879	0.0002	-3.2852	0.0005	Group ADF-stat	-4.3466	0.0000
Pedroni	Panel v- stat	3.0233	0.0013	0.7689	0.2210			
(individual intercept)	Panel rho-stat	-0.7983	0.2123	-1.9699	0.0244	Group rho-stat	0.3148	0.6236
Model 3 (CO2, EC, TO)	Panel PP stat	-3.3652	0.0004	-4.3580	0.0000	Group PP-stat	-3.4079	0.0003
	Panel ADF stat	-5.2344	0.0000	-5.9828	0.0000	Group ADF-stat	-5.1677	0.0000
Pedroni	Panel v- stat	-0.8759	0.8095	-1.6608	0.9516			
(individual intercept)	Panel rho-stat	-0.6420	0.2604	-2.6970	0.0035	Group rho-stat	-0.1225	0.4512
Model 4 (CO2, EC, UP)	Panel PP stat	-2.1205	0.0170	-6.0965	0.0000	Group PP-stat	-4.4163	0.0000
	Panel ADF stat	-2.5159	0.0059	-6.9523	0.0000	Group ADF-stat	-5.1979	0.0000
Pedroni	Panel v- stat	0.3721	0.3549	-3.2475	0.9994			
(no det. incpt or trend)	Panel rho-stat	-0.2360	0.4067	0.6988	0.7577	Group rho-stat	1.2338	0.8914
Model 5 (CO2, GDP, EC, UP)	Panel PP stat	-2.1564	0.0155	-0.9118	0.1810	Group PP-stat	-3.9361	0.0000
	Panel ADF stat	-2.7081	0.0034	-1.3742	0.0847	Group ADF-stat	-4.0780	0.0000
Pedroni	Panel v- stat	-1.0073	0.8431	-1.4830	0.9310			
(ind. incpt and trend)	Panel rho-stat	1.8238	0.9659	1.5444	0.9388	Group rho-stat	2.7639	0.9971
Model 6 (CO2, GDP, TO, UP)	Panel PP stat	-2.4183	0.0078	-3.7926	0.0001	Group PP-stat	-4.0242	0.0000
	Panel ADF stat	-5.6079	0.0000	-4.0205	0.0000	Group ADF-stat	-5.2850	0.0000
Pedroni	Panel v- stat	-0.8001	0.7882	-3.6478	0.9999			
(no det. incpt or trend)	Panel rho-stat	1.3095	0.9048	0.7202	0.7643	Group rho-stat	2.3092	0.9895
Model 7 (CO2, GDP, EC, TO,	Panel PP stat	-1.6129	0.0534	-2.3905	0.0084	Group PP-stat	-3.8022	0.0001
UP)	Panel ADF stat	-4.0113	0.0000	-2.0237	0.0215	Group ADF-stat	-4.6892	0.0000

While Model 4, Model 5, Model 6, and Model 7 provide statistical significance at 1% level, Model 2 and Model 7 provide mixed significance results at 1 % and 5% levels. The results can be found in Table 5. Note that in Model 5 Panel PP stat value's significance is 1.55% and in Model 7 the same value shows 5.34% significance; both values are negligibly above 1% and 5% respectively.

4.2.3 Panel FMOLS

The results of panel FMOLS estimates for all seven models are presented in Table 6. Models 4, 5 and 7 have the highest R-squared values all above 70%. Model 5 has the highest value with 72.55%, meaning it's the best model among the group for the equation. Top three results were obtained by using both EC and UP as the independent variables into equation where CO2 is the dependent variable. In Model 7, the inclusion of TO has decreased the R-square value slightly in relation to Model 5's highest score to 71.29%. The absence of GDP has also decreased the R-square value to 70.88%, although still has the third highest rank. The exclusion of EC in Model 6 in relation to Model 7 has significantly decreased R-square value, around 20%, to 51.03% meaning this proposed model only halfway explains the equation. Models 1, 2 and 3 have the lowest R-square values; Model 2 ranking in the bottom with 31.71%.

In Model 1, the coefficients show that GDP is negatively effecting the emissions, while energy consumption's increase result in an increase in emissions. In Model 2, while the increase in GDP also increases emissions, urban population's effect is negative. In Models 3 and 4, energy consumption positively affect the emissions where trade openness and urban population's effects are negative. Model 5 adds urban population to the equation which effects emissions negatively, however both GDP and energy consumption's increase lead to an increase in emissions. In Model 6 trade openness and urban population's increase result in decrease in emissions, on the contrary GDP increases emissions. Finally in Model 7 GDP, energy consumption and trade openness positively affect the emissions and urban population's effects are negative.

In all models urban population always provides an adverse effect to emissions. These results are different than Kasman and Duman's test results for the new EU member and candidate countries.

Table 6. Panel FMOLS

Test	coeff	std error	t-stat	prob	R-sq	Adj. R-sq
Model 1 (CO2, GDP, EC)					0.3591	0.3577
lnGDP	-0.0117	0.0380	-0.3069	0.7590		
lnEC	0.2883	0.0929	3.1016	0.0020		
Model 2 (CO2, GDP, UP)					0.3171	0.3156
lnGDP	0.3821	0.1046	3.6517	0.0003		
lnUP	-0.3440	0.2288	-1.5039	0.1333		
Model 3 (CO2, EC, TO)					0.3850	0.3836
lnEC	0.2418	0.0254	9.5043	0.0000		
lnTO	-0.0228	0.0475	-0.4614	0.6447		
Model 4 (CO2, EC, UP)					0.7088	0.7081
lnEC	1.0763	0.0787	13.6778	0.0000		
lnUP	-1.5596	0.1489	-10.4766	0.0000		
Model 5 (CO2,GDP, EC, UP)					0.7255	0.7242
lnGDP	0.2307	0.0595	3.8797	0.0001		
lnEC	0.9919	0.0454	21.8326	0.0000		
lnUP	-1.9109	0.1223	-15.6305	0.0000		
Model 6 (CO2,GDP, TO, UP)					0.5103	0.5080
lnGDP	0.7202	0.0854	8.4333	0.0000		
lnTO	-0.1005	0.0366	-2.7455	0.0063		
lnUP	-1.0777	0.1764	-6.1081	0.0000		
Model 7 (CO2,GDP, EC, TO, UP)					0.7129	0.7109
lnGDP	0.2536	0.0524	4.8439	0.0000		
lnEC	1.0249	0.0450	22.7815	0.0000		
lnTO	0.0334	0.0214	1.5618	0.1191		
lnUP	-2.0569	0.0990	-20.7849	0.0000		

CHAPTER 5

DISCUSSION AND CONCLUSION

This research was conducted to explore the relationship between emissions, GDP, energy consumption, trade openness and share of urban population for a panel of most polluting 20 countries per CCPI 2018 report. Furthermore, the EKC hypothesis was tested utilizing a series of panel unit root tests, panel cointegration and FMOLS tests. The FMOLS tests' best results were Models 5, 7, and 4 from the highest significance (72.55%) to lowest (70.88%), supporting the EKC hypothesis and the results of Kasman and Duman (2015).

Same calculations can be done for the high and middle CO2 emission groups in CCPI 2018 report to further test the EKC hypothesis or as new data becomes available same can be done for different years. Advanced and developing countries' groups may also be checked via same tests. Furthermore, the tests can be repeated for the full GHG emissions, Granger causality tests could also provide additional evidence for understanding the relationship between emissions, GDP, energy consumption, trade openness and share of urban population. Share of rural population may also be added to the independent variables for further analysis.

CCPI 2018 report suggests that even the countries most advanced on the path to meet their Paris Agreement goals still have a long way to go. Chen and Woodland (2013) state that the countries responsible for the majority of the GHG emissions are not the same as the countries that will most likely be effected by climate change, furthermore "Emitting countries may have little incentive to set stringent environmental policies…countries impacted the most…cannot affect the global emissions in a significant way" (p.408). The best way to ensure these goals are met, before it's too late, is through a global cooperation in international environmental policies and agreements. The sustainability of cooperative environmental agreements is partly dependent on their scale and scope. Additionally Chen and Woodland (2013) state that "a world with two regional agreements is better than with a single global treaty for climate control" expressing the need for a multitude of regional agreements for environmental issues.

APPENDIX

PANEL DATA

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	1	Argentina	7,130.5695	50,845,021.8167	3.6057	1,483.7794	14.7310	87.5420
1993	1	Argentina	7,612.6812	57,952,914.3418	3.4572	1,468.2208	16.2232	87.7520
1994	1	Argentina	7,952.7116	63,245,621.0251	3.5421	1,541.6575	18.1343	87.9600
1995	1	Argentina	7,630.0223	58,217,239.9032	3.6566	1,544.3558	19.7714	88.1640
1996	1	Argentina	7,955.1277	63,284,055.9558	3.8115	1,582.1382	21.5065	88.3660
1997	1	Argentina	8,500.9404	72,265,987.0357	3.8512	1,613.9190	23.3362	88.5640
1998	1	Argentina	8,728.9477	76,194,527.0968	3.8579	1,650.3437	23.3500	88.7590
1999	1	Argentina	8,339.8944	69,553,838.4144	4.0107	1,659.9928	21.3827	88.9520
2000	1	Argentina	8,182.6865	66,956,358.3951	3.8356	1,661.1170	22.6224	89.1420
2001	1	Argentina	7,735.4934	59,837,857.5905	3.5686	1,562.6864	21.8523	89.3290
2002	1	Argentina	6,816.7349	46,467,874.0885	3.2915	1,502.0372	41.7527	89.5100
2003	1	Argentina	7,337.7920	53,843,191.9905	3.5256	1,589.5451	40.6447	89.6860
2004	1	Argentina	7,913.7431	62,627,330.2267	4.0691	1,717.6505	40.6926	89.8600
2005	1	Argentina	8,522.5227	72,633,393.7241	4.1412	1,709.5724	40.5513	90.0310
2006	1	Argentina	9,112.1132	83,030,606.3024	4.4348	1,840.4404	40.4335	90.2000
2007	1	Argentina	9,830.6809	96,642,287.3474	4.3827	1,845.0981	40.9452	90.3660
2008	1	Argentina	10,125.1263	102,518,182.0263	4.6829	1,923.1398	40.4027	90.5300
2009	1	Argentina	9,428.5025	88,896,660.1689	4.4109	1,850.8615	34.0571	90.6910
2010	1	Argentina	10,276.2605	105,601,529.8167	4.5585	1,908.2806	34.9710	90.8490
2011	1	Argentina	10,780.0157	116,208,737.5810	4.6003	1,933.5230	35.2062	90.9900
2012	1	Argentina	10,557.8854	111,468,943.8926	4.5694	1,920.0810	30.5265	91.1210
2013	1	Argentina	10,699.1977	114,472,831.7654	4.4629	1,951.4395	29.3339	91.2490
2014	1	Argentina	10,323.2069	106,568,601.5211	4.7468	2,015.1870	28.4068	91.3770

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	2	Australia	35,033.3993	1,227,339,069.430	15.3178	4,959.2149	33.1103	85.2850
1993	2	Australia	36,093.5763	1,302,746,250.0918	15.7015	5,147.5367	35.4683	85.1570
1994	2	Australia	37,134.4127	1,378,964,609.9995	15.5766	5,089.7890	36.5273	85.0280
1995	2	Australia	38,093.4591	1,451,111,624.2041	15.5965	5,129.2237	37.8016	84.8980
1996	2	Australia	39,054.4732	1,525,251,879.7036	16.5018	5,393.5806	38.3323	84.7670
1997	2	Australia	40,151.8271	1,612,169,216.9454	16.5143	5,469.6000	38.0748	84.6360
1998	2	Australia	41,554.1149	1,726,744,468.1329	16.9357	5,553.6535	40.0704	84.5030
1999	2	Australia	43,143.5828	1,861,368,733.7300	17.1903	5,610.3447	39.1561	84.3700
2000	2	Australia	44,313.3182	1,963,670,172.3244	17.2006	5,644.0650	41.0476	84.2350
2001	2	Australia	44,564.9766	1,986,037,135.7321	16.7334	5,446.9732	44.3841	84.1000
2002	2	Australia	45,786.6428	2,096,416,659.8537	17.3705	5,569.6410	41.5744	84.2220
2003	2	Australia	46,575.4153	2,169,269,313.3525	16.9020	5,568.7649	40.3129	84.3430
2004	2	Australia	47,880.6117	2,292,552,972.7118	17.0265	5,598.0882	37.1563	84.4630
2005	2	Australia	48,760.3552	2,377,572,236.2317	17.1697	5,564.0872	39.3146	84.5820
2006	2	Australia	49,408.0527	2,441,155,675.6266	17.6514	5,709.3447	41.6339	84.7000
2007	2	Australia	50,955.0559	2,596,417,726.6883	17.8653	5,868.3471	42.1076	84.8220
2008	2	Australia	51,770.9072	2,680,226,827.4470	18.1609	5,964.6658	42.9278	84.9430
2009	2	Australia	51,689.9136	2,671,847,163.4113	18.2002	5,862.5519	45.8650	85.0630
2010	2	Australia	51,936.8887	2,697,440,409.0459	17.7408	5,793.1160	40.7164	85.1820
2011	2	Australia	52,475.6632	2,753,695,233.0574	17.5389	5,745.2322	41.9779	85.3000
2012	2	Australia	53,574.4588	2,870,222,636.1531	17.0729	5,575.2871	43.2871	85.4020
2013	2	Australia	54,050.2093	2,921,425,124.5595	16.0958	5,468.3914	41.2736	85.5020
2014	2	Australia	54,612.3118	2,982,504,602.9192	15.3888	5,334.6817	42.5798	85.6020

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	3	Brazil	7,776.3872	60,472,197.5392	1.4279	933.9006	19.2533	75.4440
1993	3	Brazil	8,006.1304	64,098,124.3835	1.4684	941.6245	19.5993	76.1810
1994	3	Brazil	8,297.3840	68,846,580.6564	1.5163	975.3158	19.3329	76.9030
1995	3	Brazil	8,525.5160	72,684,423.6178	1.5918	992.5945	16.9845	77.6100
1996	3	Brazil	8,575.4585	73,538,487.8874	1.7269	1,028.8017	15.6356	78.3020
1997	3	Brazil	8,727.3027	76,165,812.4548	1.7938	1,064.0480	16.5762	79.0480
1998	3	Brazil	8,621.7052	74,333,800.2474	1.8352	1,072.7641	16.4386	79.7810
1999	3	Brazil	8,532.2583	72,799,431.8601	1.8533	1,080.6411	20.9822	80.4960
2000	3	Brazil	8,778.1802	77,056,447.4375	1.8711	1,069.3375	22.6398	81.1920
2001	3	Brazil	8,776.8583	77,033,241.6210	1.8984	1,072.9173	26.9363	81.5530
2002	3	Brazil	8,924.3417	79,643,874.9794	1.8444	1,086.6367	27.6184	81.8800
2003	3	Brazil	8,910.8481	79,403,214.0646	1.7625	1,090.3890	28.1404	82.2030
2004	3	Brazil	9,309.0081	86,657,632.7034	1.8287	1,136.9682	29.6783	82.5210
2005	3	Brazil	9,495.1045	90,157,010.1986	1.8581	1,152.0163	27.0868	82.8340
2006	3	Brazil	9,761.8841	95,294,380.6223	1.8394	1,178.8509	26.0417	83.1430
2007	3	Brazil	10,245.2386	104,964,914.9187	1.9014	1,232.6017	25.2926	83.4480
2008	3	Brazil	10,658.2186	113,597,623.0129	2.0087	1,288.1173	27.2576	83.7490
2009	3	Brazil	10,540.1085	111,093,888.1267	1.8838	1,233.7536	22.1060	84.0440
2010	3	Brazil	11,224.1541	125,981,634.8775	2.1329	1,351.0289	22.7722	84.3350
2011	3	Brazil	11,559.2120	133,615,382.3559	2.2116	1,359.1224	23.9344	84.6310
2012	3	Brazil	11,671.1856	136,216,573.7943	2.3436	1,404.7553	25.1143	84.9230
2013	3	Brazil	11,912.1446	141,899,187.8351	2.4884	1,451.1678	25.7860	85.2090
2014	3	Brazil	11,866.3860	140,811,117.0109	2.5944	1,484.9266	24.6854	85.4920

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	4	Canada	35,108.5190	1,232,608,109.0273	15.4623	7,562.1481	52.7175	76.8870
1993	4	Canada	35,648.4780	1,270,813,982.8345	15.4536	7,730.4866	58.2449	77.1520
1994	4	Canada	36,893.9819	1,361,165,899.3699	15.6929	7,926.8392	64.3983	77.4140
1995	4	Canada	37,569.4682	1,411,464,943.8696	15.9310	7,965.8468	69.0974	77.6750
1996	4	Canada	37,765.7325	1,426,250,547.5474	16.1574	8,036.7133	70.2995	77.9510
1997	4	Canada	38,967.9531	1,518,501,368.9121	16.5169	8,034.4148	74.3851	78.3400
1998	4	Canada	40,131.7018	1,610,553,492.0901	16.7461	7,924.0309	78.1589	78.7240
1999	4	Canada	41,856.0456	1,751,928,552.6322	16.8985	8,081.4870	80.1940	79.1030
2000	4	Canada	43,638.2832	1,904,299,756.6998	17.3671	8,242.5247	82.8577	79.4780
2001	4	Canada	43,964.9546	1,932,917,232.4557	16.9850	8,040.5389	78.4063	79.8100
2002	4	Canada	44,883.8284	2,014,558,051.4380	16.5594	7,993.3897	75.7327	79.8880
2003	4	Canada	45,239.8114	2,046,640,534.6643	17.4612	8,332.9239	69.8434	79.9670
2004	4	Canada	46,170.9202	2,131,753,871.7944	17.2589	8,441.1849	70.1805	80.0450
2005	4	Canada	47,181.5624	2,226,099,829.9431	17.2511	8,404.2459	69.7098	80.1220
2006	4	Canada	48,035.0358	2,307,364,663.5296	16.6967	8,240.1156	67.9812	80.2130
2007	4	Canada	48,552.6964	2,357,364,330.7530	16.8559	8,213.6635	66.1920	80.3960
2008	4	Canada	48,510.5678	2,353,275,185.6853	16.8752	8,195.2123	66.9242	80.5780
2009	4	Canada	46,543.7922	2,166,324,592.3485	15.9616	7,797.1963	58.3482	80.7580
2010	4	Canada	47,447.4760	2,251,262,981.0664	15.7232	7,788.4726	60.0607	80.9370
2011	4	Canada	48,456.9646	2,348,077,415.7498	15.6398	7,910.7594	62.3286	81.0960
2012	4	Canada	48,724.2458	2,374,052,128.8111	14.8906	7,725.3283	62.3971	81.1370
2013	4	Canada	49,359.4225	2,436,352,586.5301	14.7120	7,728.4341	61.9734	81.1780
2014	4	Canada	50,221.8420	2,522,233,412.0825	15.1172	7,876.0941	64.0576	81.2180

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	5	China	888.9110	790.162.7732	2.3095	752.6287	30.1457	28.2000
1993	5	China	1,000.6118	1,001,223.9938	2.4428	788.1287	36,0561	29.1030
1994	5	China	1,118.4996	1,251,041.3048	2.5660	816.1629	35.7698	30.0240
1995	5	China	1,227.5564	1,506,894.7322	2.7558	866.8344	34.2741	30.9610
1996	5	China	1,335.3627	1,783,193.4874	2.8443	881.6537	33.8147	31.9160
1997	5	China	1,443.7747	2,084,485.5052	2.8206	871.7563	34.5330	32.8830
1998	5	China	1,542.0641	2,377,961.7809	2.6767	869.3586	32.4247	33.8670
1999	5	China	1,645.9880	2,709,276.4819	2.6486	878.5245	33.5246	34.8650
2000	5	China	1,771.7415	3,139,067.9634	2.6969	898.9873	39.4105	35.8770
2001	5	China	1,905.6108	3,631,352.4453	2.7421	928.8114	38.5274	37.0930
2002	5	China	2,065.7186	4,267,193.2487	3.0071	984.8107	42.7474	38.4250
2003	5	China	2,258.9121	5,102,683.9000	3.5241	1,118.4318	51.8040	39.7760
2004	5	China	2,472.5866	6,113,684.2754	4.0380	1,268.1329	59.5055	41.1440
2005	5	China	2,738.2055	7,497,769.1409	4.5232	1,393.6913	62.2079	42.5220
2006	5	China	3,069.3048	9,420,631.8384	4.9803	1,515.1737	64.4789	43.8680
2007	5	China	3,487.8458	12,165,068.0847	5.3349	1,630.1710	62.1046	45.1990
2008	5	China	3,805.0260	14,478,222.8505	5.7019	1,672.9041	57.4529	46.5390
2009	5	China	4,142.0383	17,156,481.1625	6.0101	1,778.4335	44.6054	47.8800
2010	5	China	4,560.5126	20,798,275.0471	6.5605	1,954.7226	48.8893	49.2260
2011	5	China	4,971.5449	24,716,258.9774	7.2415	2,086.4869	50.5998	50.5110
2012	5	China	5,336.0601	28,473,537.8518	7.4248	2,155.1648	48.1079	51.7650
2013	5	China	5,721.6938	32,737,780.1571	7.5572	2,213.7593	46.5652	53.0130
2014	5	China	6,108.2388	37,310,580.9318	7.5439	2,236.7299	44.8766	54.2590

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	6	Germany	34,130.8524	1,164,915,085.3836	11.0633	4,190.9842	45.0500	73.3600
1993	6	Germany	33,583.0060	1,127,818,294.3956	10.8142	4,122.6957	40.6443	73.4970
1994	6	Germany	34,289.1247	1,175,744,076.0722	10.6284	4,088.7981	42.0730	73.7100
1995	6	Germany	34,782.5686	1,209,827,080.1740	10.5795	4,119.6889	43.5447	73.9220
1996	6	Germany	34,965.6909	1,222,599,539.1682	10.8602	4,246.5532	44.9967	74.1330
1997	6	Germany	35,560.2093	1,264,528,484.4602	10.5111	4,203.3574	49.6010	74.3420
1998	6	Germany	36,258.6744	1,314,691,471.5446	10.4253	4,177.2941	51.5829	74.5510
1999	6	Germany	36,955.2896	1,365,693,429.9447	10.0178	4,079.9333	53.3694	74.7580
2000	6	Germany	37,998.4253	1,443,880,326.1916	10.0956	4,094.0604	61.3900	74.9650
2001	6	Germany	38,577.7256	1,488,240,914.7318	10.3663	4,209.7961	61.9778	75.1700
2002	6	Germany	38,512.9200	1,483,245,010.0924	10.0587	4,108.4013	60.7730	75.3740
2003	6	Germany	38,218.3496	1,460,642,249.6328	9.9694	4,084.5033	61.5191	75.5770
2004	6	Germany	38,673.8881	1,495,669,621.7927	9.8987	4,114.3899	65.8561	75.7790
2005	6	Germany	38,969.3217	1,518,608,033.6071	9.6664	4,086.5034	70.4212	75.9800
2006	6	Germany	40,456.8574	1,636,757,309.0881	9.9115	4,204.6547	77.0822	76.1790
2007	6	Germany	41,831.8671	1,749,905,104.0940	9.4880	3,985.8120	79.3705	76.3780
2008	6	Germany	42,365.0975	1,794,801,485.8101	9.5063	4,036.8308	80.9449	76.5750
2009	6	Germany	40,086.1048	1,606,895,794.7849	8.8186	3,790.5012	70.6650	76.7710
2010	6	Germany	41,785.5569	1,746,032,766.4923	9.2796	3,997.0794	79.3031	76.9660
2011	6	Germany	44,125.3314	1,947,044,872.1880	9.1249	3,869.8162	84.7477	77.1600
2012	6	Germany	44,259.2599	1,958,882,087.3736	9.1993	3,876.9481	85.8748	77.1700
2013	6	Germany	44,354.7369	1,967,342,684.2730	9.3906	3,939.5296	84.8364	77.1800
2014	6	Germany	45,132.2736	2,036,922,123.3092	8.8894	3,779.4619	84.3653	77.1900

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	7	European Union	25,234.0773	636,758,659.6786	8.3120	3,347.4220	51.3816	70.7292
1993	7	European Union	25,117.7039	630,899,046.7879	8.1708	3,332.1682	50.6148	70.8499
1994	7	European Union	25,765.7781	663,875,322.7592	8.0390	3,309.9833	53.1290	70.9808
1995	7	European Union	26,404.4682	697,195,942.9742	8.1530	3,404.1240	55.7982	71.1125
1996	7	European Union	26,881.0414	722,590,387.1021	8.3616	3,516.4270	56.5039	71.2437
1997	7	European Union	27,614.2177	762,545,020.1722	8.1568	3,475.8332	59.7994	71.3702
1998	7	European Union	28,393.8884	806,212,896.9208	8.1562	3,490.2878	60.6696	71.4946
1999	7	European Union	29,195.2811	852,364,441.1590	7.9920	3,454.8362	61.5186	71.6232
2000	7	European Union	30,278.7636	916,803,524.2682	8.0127	3,471.7360	68.6244	71.7697
2001	7	European Union	30,895.9561	954,560,101.5100	8.1750	3,547.9773	67.9935	71.9478
2002	7	European Union	31,235.3887	975,649,506.5190	8.1060	3,533.7469	65.8081	72.1858
2003	7	European Union	31,529.5217	994,110,738.0215	8.2248	3,595.2945	64.7446	72.4175
2004	7	European Union	32,210.8303	1,037,537,590.6261	8.2103	3,618.2256	67.4031	72.6462
2005	7	European Union	32,760.8786	1,073,275,166.4386	8.1449	3,615.6712	70.4390	72.8760
2006	7	European Union	33,731.2613	1,137,797,989.2268	8.1788	3,616.1443	74.9136	73.1045
2007	7	European Union	34,634.8570	1,199,573,322.4941	8.0102	3,541.0156	75.9563	73.3355
2008	7	European Union	34,670.9361	1,202,073,807.0863	7.8043	3,512.6639	77.5693	73.5655
2009	7	European Union	33,063.6427	1,093,204,467.4682	7.1574	3,299.5890	68.4121	73.7866
2010	7	European Union	33,729.0427	1,137,648,322.1952	7.3563	3,420.9645	75.6801	74.0091
2011	7	European Union	34,341.0752	1,179,309,442.9285	7.0795	3,289.9754	80.8905	74.2226
2012	7	European Union	34,131.0949	1,164,931,637.4156	6.9178	3,257.2997	82.2203	74.4264
2013	7	European Union	34,117.5024	1,164,003,969.4517	6.7538	3,210.3678	81.9331	74.6233
2014	7	European Union	34,617.1775	1,198,348,976.9199	6.3791	3,079.4839	82.3743	74.8173

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	8	France	33,216.0090	1,103,303,253.6161	6.2173	3,954.0032	41.9916	74.4010
1993	8	France	32,869.7790	1,080,422,369.7505	6.0893	4,001.9015	39.9051	74.5720
1994	8	France	33,515.7135	1,123,303,052.2336	5.6992	3,836.1124	41.8262	74.7430
1995	8	France	34,091.1674	1,162,207,697.9597	5.8641	3,981.3525	43.6461	74.9120
1996	8	France	34,442.1844	1,186,264,065.8331	6.2810	4,191.9238	44.3292	75.0820
1997	8	France	35,122.7463	1,233,607,306.5197	5.8628	4,049.2325	48.0335	75.2500
1998	8	France	36,237.9630	1,313,189,962.7136	6.2713	4,151.6272	49.5068	75.4170
1999	8	France	37,280.3411	1,389,823,830.2328	6.0982	4,123.5263	49.7609	75.6140
2000	8	France	38,460.6821	1,479,224,067.6599	5.9467	4,135.4776	55.8612	75.8710
2001	8	France	38,928.0303	1,515,391,543.5415	6.1531	4,246.0049	54.9594	76.1270
2002	8	France	39,078.1987	1,527,105,613.8062	6.0687	4,225.4680	53.0720	76.3800
2003	8	France	39,120.1961	1,530,389,746.0995	6.1160	4,270.9495	50.7978	76.6320
2004	8	France	39,915.2645	1,593,228,343.4411	6.1201	4,301.7372	51.9250	76.8830
2005	8	France	40,252.4182	1,620,257,172.4469	6.0996	4,287.1574	53.9807	77.1300
2006	8	France	40,922.0832	1,674,616,895.5604	5.9063	4,188.8429	56.1034	77.3770
2007	8	France	41,630.0937	1,733,064,704.5522	5.7664	4,115.5272	56.4208	77.6210
2008	8	France	41,478.9374	1,720,502,248.3178	5.6905	4,110.5853	57.3971	77.8680
2009	8	France	40,052.3051	1,604,187,145.4579	5.4384	3,913.4574	50.4625	78.1170
2010	8	France	40,638.3340	1,651,474,190.6418	5.4290	4,016.8479	54.8678	78.3690
2011	8	France	41,329.0385	1,708,089,425.9296	5.0779	3,847.0730	58.7906	78.6220
2012	8	France	41,258.2873	1,702,246,271.1502	5.0751	3,836.6578	59.7021	78.8780
2013	8	France	41,283.0077	1,704,286,724.4169	5.0622	3,833.5357	59.7641	79.1350
2014	8	France	41,478.2520	1,720,445,386.4207	4.5732	3,658.8657	60.4788	79.3940

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	9	United Kingdom	28,321.0345	802,080,996.6345	9.6609	3,684.7245	45.1278	78.1720
1993	9	United Kingdom	28,967.1550	839,096,071.4217	9.4547	3,713.1858	48.4803	78.2320
1994	9	United Kingdom	30,014.5814	900,875,096.5511	9.4484	3,732.5211	50.5617	78.2930
1995	9	United Kingdom	30,674.6055	940,931,425.4349	9.2748	3,728.9632	50.0457	78.3530
1996	9	United Kingdom	31,373.3412	984,286,537.4056	9.4802	3,879.8228	51.3052	78.4130
1997	9	United Kingdom	32,556.3167	1,059,913,756.7733	9.0427	3,760.7124	50.1835	78.4720
1998	9	United Kingdom	33,480.1660	1,120,921,516.2851	9.0944	3,787.1085	48.2615	78.5320
1999	9	United Kingdom	34,442.1071	1,186,258,741.1149	9.0476	3,784.0741	48.7642	78.5910
2000	9	United Kingdom	35,576.7668	1,265,706,339.3117	9.1995	3,785.7531	51.5309	78.6510
2001	9	United Kingdom	36,341.7098	1,320,719,867.5885	9.2332	3,784.9282	51.7805	78.7510
2002	9	United Kingdom	37,077.6484	1,374,752,007.5292	8.9041	3,685.8695	50.3423	79.0470
2003	9	United Kingdom	38,132.8411	1,454,113,569.2831	9.0533	3,731.6097	49.4716	79.3390
2004	9	United Kingdom	38,813.0217	1,506,450,652.9935	8.9891	3,694.4786	49.5114	79.6290
2005	9	United Kingdom	39,740.9029	1,579,339,365.0017	8.9829	3,686.3599	51.9390	79.9150
2006	9	United Kingdom	40,418.7473	1,633,675,133.6847	8.8987	3,598.8104	55.8255	80.1990
2007	9	United Kingdom	41,050.4059	1,685,135,826.7292	8.6172	3,441.6402	52.2021	80.4790
2008	9	United Kingdom	40,536.1349	1,643,178,229.1808	8.4244	3,361.9805	56.4679	80.7570
2009	9	United Kingdom	38,545.9158	1,485,787,626.1267	7.5746	3,145.5857	54.4447	81.0310
2010	9	United Kingdom	39,079.8426	1,527,234,098.0770	7.8578	3,230.6160	58.5385	81.3020
2011	9	United Kingdom	39,413.3239	1,553,410,099.1877	7.0793	2,972.1480	62.0101	81.5700
2012	9	United Kingdom	39,706.6101	1,576,614,884.2864	7.3559	3,042.8558	61.0877	81.8370
2013	9	United Kingdom	40,248.7651	1,619,963,092.9938	7.1458	2,987.7028	61.0946	82.1020
2014	9	United Kingdom	41,124.1434	1,691,195,170.7399	6.4974	2,776.8441	58.0308	82.3650

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	10	Indonesia	1,878.7099	3,529,550.7390	1.0789	574.4848	57.4274	32.7030
1993	10	Indonesia	1,968.1241	3,873,512.6163	1.1452	620.7103	50.5234	33.8080
1994	10	Indonesia	2,083.0637	4,339,154.3021	1.1416	611.7073	51.8771	34.9330
1995	10	Indonesia	2,219.8111	4,927,561.1338	1.1421	664.3573	53.9586	36.0760
1996	10	Indonesia	2,357.9594	5,559,972.3030	1.2670	678.2717	52.2647	37.2350
1997	10	Indonesia	2,433.3405	5,921,146.0260	1.3739	691.0022	55.9939	38.4060
1998	10	Indonesia	2,084.2345	4,344,033.6530	1.0412	666.4000	96.1862	39.5930
1999	10	Indonesia	2,071.5506	4,291,322.0115	1.1600	688.3820	62.9439	40.7920
2000	10	Indonesia	2,143.3899	4,594,120.2222	1.2452	735.8209	71.4369	42.0020
2001	10	Indonesia	2,190.7662	4,799,456.4545	1.3748	742.6968	69.7932	42.7830
2002	10	Indonesia	2,257.7469	5,097,420.8616	1.4102	759.6426	59.0795	43.5680
2003	10	Indonesia	2,333.0975	5,443,343.8667	1.4364	751.3089	53.6165	44.3560
2004	10	Indonesia	2,416.8364	5,841,098.1328	1.5099	789.9270	59.7613	45.1490
2005	10	Indonesia	2,519.5098	6,347,929.8416	1.5085	792.9269	63.9879	45.9420
2006	10	Indonesia	2,621.9604	6,874,676.3283	1.5016	800.5394	56.6571	46.7380
2007	10	Indonesia	2,750.6151	7,565,883.6633	1.6119	785.9928	54.8292	47.5350
2008	10	Indonesia	2,876.8850	8,276,467.5349	1.7639	790.7844	58.5614	48.3350
2009	10	Indonesia	2,970.0441	8,821,162.1405	1.8652	843.4525	45.5121	49.1340
2010	10	Indonesia	3,113.4806	9,693,761.6615	1.7679	874.5806	46.7013	49.9140
2011	10	Indonesia	3,262.7486	10,645,528.5091	2.4568	831.5560	50.1800	50.5950
2012	10	Indonesia	3,415.3513	11,664,624.2754	2.5598	851.7314	49.5829	51.2760
2013	10	Indonesia	3.560,1066	12.674.358,8640	1,9451	863,0435	48,6374	51,9550
2014	10	Indonesia	3.692,9429	13.637.827,0807	1,8194	883,9110	48,0802	52,6350

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	11	India	597.1714	356,613.6537	0.7716	364.3951	18.4331	25.9840
1993	11	India	613.3317	376,175.7588	0.7832	365.8344	19.6515	26.1910
1994	11	India	641.5739	411,617.0693	0.8116	372.5646	20.0781	26.3990
1995	11	India	677.0355	458,377.1076	0.8450	386.4710	22.8674	26.6070
1996	11	India	714.4539	510,444.3866	0.9013	390.8078	21.9295	26.8170
1997	11	India	729.5905	532,302.3521	0.9201	398.7705	22.6194	27.0280
1998	11	India	760.5522	578,439.6897	0.9215	400.8788	23.6995	27.2400
1999	11	India	812.9731	660,925.3213	0.9625	416.3740	24.8156	27.4530
2000	11	India	829.3591	687,836.4994	0.9799	418.6843	26.9009	27.6670
2001	11	India	854.4160	730,026.6793	0.9717	417.3820	25.9933	27.9180
2002	11	India	872.0009	760,385.5011	0.9674	422.6273	29.5087	28.2440
2003	11	India	925.0769	855,767.2366	0.9924	425.6328	30.5924	28.5720
2004	11	India	982.3167	964,946.1049	1.0250	441.0648	37.5038	28.9030
2005	11	India	1,043.4868	1,088,864.6276	1.0686	451.1383	42.0017	29.2350
2006	11	India	1,110.2687	1,232,696.6684	1.1220	467.5458	45.7245	29.5690
2007	11	India	1,177.3862	1,386,238.2499	1.1932	486.5505	45.6863	29.9060
2008	11	India	1,196.0210	1,430,466.1910	1.3101	503.0356	53.3682	30.2460
2009	11	India	1,271.8589	1,617,625.0283	1.4318	546.1767	46.2729	30.5870
2010	11	India	1,361.2036	1,852,875.1623	1.3970	563.1593	49.2552	30.9300
2011	11	India	1,413.8780	1,999,050.9858	1.4767	579.4087	55.6239	31.2760
2012	11	India	1,472.3379	2,167,778.7749	1.5981	600.4432	55.7937	31.6340
2013	11	India	1,547.3784	2,394,379.8578	1.5914	606.8743	53.8441	32.0030
2014	11	India	1,642.3926	2,697,453.3990	1.7300	637.4286	48.9222	32.3840

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	12	Iran, Islamic Rep.	4,625.6880	21,396,989.7136	3.9215	1,388.6332	40.3979	57.6530
1993	12	Iran, Islamic Rep.	4,615.9201	21,306,718.6731	4.0212	1,476.5945	46.0409	58.5190
1994	12	Iran, Islamic Rep.	4,490.2830	20,162,641.8424	4.4409	1,619.1536	41.6091	59.3800
1995	12	Iran, Islamic Rep.	4,528.2955	20,505,460.5246	4.5058	1,670.8235	35.1442	60.2360
1996	12	Iran, Islamic Rep.	4,684.6459	21,945,906.9866	4.4827	1,585.2775	35.2213	61.0870
1997	12	Iran, Islamic Rep.	4,622.5972	21,368,404.8265	4.2942	1,742.2507	32.6496	61.8530
1998	12	Iran, Islamic Rep.	4,635.3039	21,486,042.5445	4.8279	1,741.2597	29.2282	62.5880
1999	12	Iran, Islamic Rep.	4,591.4615	21,081,518.9206	5.8765	1,939.9929	34.8854	63.3180
2000	12	Iran, Islamic Rep.	4,781.8508	22,866,097.2997	5.6287	1,860.2582	41.2572	64.0420
2001	12	Iran, Islamic Rep.	4,749.8063	22,560,659.9692	5.9383	1,989.2767	40.5356	64.7580
2002	12	Iran, Islamic Rep.	5,028.4374	25,285,182.2988	5.9097	2,030.7066	48.1727	65.4680
2003	12	Iran, Islamic Rep.	5,401.7502	29,178,905.2111	6.0808	2,073.2763	50.6791	66.1720
2004	12	Iran, Islamic Rep.	5,572.9057	31,057,278.1301	6.4214	2,234.8818	51.3139	66.8690
2005	12	Iran, Islamic Rep.	5,684.9575	32,318,741.7851	6.6571	2,451.9098	54.4405	67.5580
2006	12	Iran, Islamic Rep.	5,901.6418	34,829,375.8030	7.1508	2,533.5922	53.1674	68.2390
2007	12	Iran, Islamic Rep.	6,311.7895	39,838,686.6943	7.2097	2,650.7880	49.8873	68.8640
2008	12	Iran, Islamic Rep.	6,256.8780	39,148,521.9016	7.4347	2,808.9497	48.2294	69.4580
2009	12	Iran, Islamic Rep.	6,247.6917	39,033,651.0799	7.5220	2,771.5278	43.6996	70.0450
2010	12	Iran, Islamic Rep.	6,531.9274	42,666,075.9466	7.6847	2,739.5659	43.7706	70.6260
2011	12	Iran, Islamic Rep.	6,622.6729	43,859,796.8796	7.8029	2,759.4362	43.1913	71.2000
2012	12	Iran, Islamic Rep.	6,052.5168	36,632,960.0091	8.0017	2,835.0413	47.3731	71.7550
2013	12	Iran, Islamic Rep.	5,964.1790	35,571,431.6936	8.0038	2,853.5371	50.3314	72.2950
2014	12	Iran, Islamic Rep.	6,161.1035	37,959,196.6168	8.2830	3,023.4904	44.6044	72.8300

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	13	Japan	39,488.3934	1,559,333,216.0397	9.0466	3,649.9443	17.3298	77.6100
1993	13	Japan	39,187.0345	1,535,623,675.8432	8.9122	3,664.5684	16.0139	77.7460
1994	13	Japan	39,441.5868	1,555,638,766.3232	9.3895	3,850.9624	16.1045	77.8810
1995	13	Japan	40,368.7123	1,629,632,931.3309	9.4344	3,935.9948	16.6795	78.0160
1996	13	Japan	41,514.8978	1,723,486,738.9019	9.5795	4,008.4762	18.5245	78.1450
1997	13	Japan	41,861.7534	1,752,406,400.9530	9.5258	4,041.1677	20.0407	78.2720
1998	13	Japan	41,277.0668	1,703,796,240.2112	9.1600	3,955.6276	19.2320	78.3980
1999	13	Japan	41,097.9596	1,689,042,283.6098	9.4488	4,011.2248	18.3490	78.5230
2000	13	Japan	42,169.7333	1,778,286,405.2245	9.6224	4,083.8317	19.8197	78.6490
2001	13	Japan	42,239.1849	1,784,148,743.2443	9.4643	4,008.2680	19.7981	79.9900
2002	13	Japan	42,190.8049	1,780,064,015.8147	9.5731	3,991.9776	20.6856	81.6470
2003	13	Japan	42,744.0113	1,827,050,500.7314	9.7253	3,953.1845	21.5831	83.1960
2004	13	Japan	43,671.6800	1,907,215,631.7429	9.9092	4,078.2105	23.9224	84.6400
2005	13	Japan	44,393.6264	1,970,794,063.5411	9.6989	4,062.9790	26.5155	85.9780
2006	13	Japan	44,995.4945	2,024,594,524.5724	9.6320	4,053.8834	30.3318	87.1180
2007	13	Japan	45,687.2738	2,087,326,988.6254	9.7830	4,012.6542	33.0939	88.1460
2008	13	Japan	45,165.7879	2,039,948,398.3229	9.4495	3,858.4345	34.3990	89.1030
2009	13	Japan	42,724.7604	1,825,405,148.6697	8.6208	3,678.5111	24.4909	89.9890
2010	13	Japan	44,507.6764	1,980,933,257.2735	9.1483	3,893.2666	28.6130	90.8120
2011	13	Japan	44,538.7262	1,983,698,130.6898	9.3174	3,610.8122	30.3930	91.0690
2012	13	Japan	45,276.8743	2,049,995,349.5855	9.6386	3,537.3632	30.6361	91.1480
2013	13	Japan	46,249.2096	2,138,989,387.5748	9.7808	3,567.6294	34.1475	91.2260
2014	13	Japan	46,484.1553	2,160,776,690.8767	9.5387	3,470.7631	37.5458	91.3040

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	14	Korea, Rep.	9,719.0620	94,460,166.2451	6.4981	2,534.3410	49.4886	75.8200
1993	14	Korea, Rep.	10,279.5473	105,669,092.1971	7.2849	2,814.1882	47.5874	76.6450
1994	14	Korea, Rep.	11,113.5131	123,510,173.3569	7.7067	2,958.4077	48.8755	77.4520
1995	14	Korea, Rep.	12,055.2313	145,328,601.4178	8.3111	3,210.1320	52.7851	78.2390
1996	14	Korea, Rep.	12,847.7710	165,065,219.5826	8.8695	3,454.8549	53.5044	78.6620
1997	14	Korea, Rep.	13,481.6262	181,754,244.2223	9.3580	3,726.1578	58.6330	78.9050
1998	14	Korea, Rep.	12,652.3535	160,082,048.7180	7.8821	3,377.6351	69.9878	79.1450
1999	14	Korea, Rep.	13,983.4128	195,535,834.3473	8.5777	3,708.7052	61.4361	79.3840
2000	14	Korea, Rep.	15,104.5215	228,146,570.2770	9.5209	4,002.6713	67.9472	79.6210
2001	14	Korea, Rep.	15,667.3785	245,466,747.7909	9.5037	4,033.3190	63.9111	79.9400
2002	14	Korea, Rep.	16,734.8457	280,055,059.3986	9.7730	4,170.4761	60.1537	80.2990
2003	14	Korea, Rep.	17,136.6616	293,665,169.6658	9.7346	4,233.4873	63.3930	80.6520
2004	14	Korea, Rep.	17,905.2258	320,597,110.6428	10.0302	4,332.6677	72.7611	81.0020
2005	14	Korea, Rep.	18,568.3628	344,784,097.6186	9.6073	4,364.2191	71.1843	81.3450
2006	14	Korea, Rep.	19,427.1898	377,415,705.1352	9.7166	4,412.5271	73.5513	81.5280
2007	14	Korea, Rep.	20,385.3200	415,561,273.0501	10.1816	4,564.9878	77.2430	81.6310
2008	14	Korea, Rep.	20,803.5005	432,785,634.7345	10.3474	4,629.7779	99.9336	81.7330
2009	14	Korea, Rep.	20,843.1348	434,436,268.3115	10.3201	4,649.7657	90.4126	81.8350
2010	14	Korea, Rep.	22,086.9529	487,833,489.2603	11.4363	5,045.4877	95.6541	81.9360
2011	14	Korea, Rep.	22,724.7056	516,412,243.2787	11.8030	5,216.5878	110.0001	81.9230
2012	14	Korea, Rep.	23,123.7614	534,708,339.3210	11.6328	5,248.5199	109.8862	81.8510
2013	14	Korea, Rep.	23,685.4067	560,998,491.0675	11.7492	5,231.6755	102.7707	81.7790
2014	14	Korea, Rep.	24,323.5728	591,636,195.5850	11.5703	5,289.2758	95.2972	81.7070

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	15	Mexico	7,944.3396	63,112,532.2554	3.7679	1,474.0005	35.5535	72.2090
1993	15	Mexico	7,940.1441	63,045,889.0540	3.7469	1,469.4686	27.8279	72.5980
1994	15	Mexico	8,174.6920	66,825,589.6308	3.8201	1,474.0871	30.7100	72.9850
1995	15	Mexico	7,522.2218	56,583,821.4042	3.5389	1,401.2295	46.3210	73.3680
1996	15	Mexico	7,893.9074	62,313,774.4572	3.6203	1,407.5455	50.4192	73.6700
1997	15	Mexico	8,296.1659	68,826,368.0013	3.8010	1,456.8764	48.7774	73.9290
1998	15	Mexico	8,588.6379	73,764,700.1406	3.9373	1,474.1742	50.9961	74.1860
1999	15	Mexico	8,694.9873	75,602,804.1464	3.9042	1,494.3595	50.6180	74.4410
2000	15	Mexico	8,997.4336	80,953,811.6998	3.9165	1,474.5923	52.4327	74.7220
2001	15	Mexico	8,843.9012	78,214,587.7272	4.0069	1,506.7204	47.1661	75.0450
2002	15	Mexico	8,731.2200	76,234,203.0477	3.9709	1,495.4426	46.6979	75.3650
2003	15	Mexico	8,749.7780	76,558,615.6685	4.1670	1,565.0777	50.2057	75.6820
2004	15	Mexico	8,977.6578	80,598,339.9535	4.1246	1,562.0853	58.4243	75.9970
2005	15	Mexico	9,059.8105	82,080,166.0479	4.2994	1,646.7748	62.3591	76.3080
2006	15	Mexico	9,327.7362	87,006,662.6151	4.3532	1,659.5163	56.0927	76.6160
2007	15	Mexico	9,392.6871	88,222,571.1848	4.2966	1,622.9711	56.7953	76.9200
2008	15	Mexico	9,347.5243	87,376,210.1415	4.3396	1,580.6621	57.7770	77.2220
2009	15	Mexico	8,712.1406	75,901,393.7816	4.1206	1,557.4002	55.9678	77.5200
2010	15	Mexico	9,016.4579	81,296,513.5520	3.9577	1,489.6374	60.7603	77.8150
2011	15	Mexico	9,207.7293	84,782,279.1793	4.0678	1,541.8341	63.4697	78.1110
2012	15	Mexico	9,405.8132	88,469,321.3063	4.1077	1,586.6130	65.7672	78.4050
2013	15	Mexico	9,400.3221	88,366,055.9650	4.0016	1,567.6834	63.7649	78.6990
2014	15	Mexico	9,532.8038	90,874,348.9956	3.8662	1,513.2592	64.9636	78.9930

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	16	Russian Federation	7,717.1014	59,553,654.1344	13.9800	5,351.0771	110.5771	73.3850
1993	16	Russian Federation	7,056.1614	49,789,413.6436	13.0517	5,057.7788	68.6984	73.3810
1994	16	Russian Federation	6,176.8716	38,153,742.6845	11.4495	4,428.8142	50.9537	73.3760
1995	16	Russian Federation	5,919.3459	35,038,655.8737	10.9956	4,290.6952	55.1829	73.3720
1996	16	Russian Federation	5,714.5563	32,656,153.9357	10.8867	4,252.6141	47.9225	73.3670
1997	16	Russian Federation	5,804.1476	33,688,128.9645	10.3168	4,069.6888	47.2569	73.3630
1998	16	Russian Federation	5,505.6327	30,311,991.2855	10.1273	3,981.5019	55.7723	73.3590
1999	16	Russian Federation	5,876.1504	34,529,143.3680	10.4007	4,136.7619	69.3933	73.3540
2000	16	Russian Federation	6,491.0071	42,133,173.5982	10.6271	4,224.2862	68.0939	73.3500
2001	16	Russian Federation	6,850.5232	46,929,668.4194	10.6696	4,288.3944	61.1109	73.3460
2002	16	Russian Federation	7,208.5771	51,963,584.2967	10.7159	4,288.2072	59.6454	73.3410
2003	16	Russian Federation	7,769.6771	60,367,882.7991	11.0906	4,461.3165	59.1283	73.3730
2004	16	Russian Federation	8,360.8194	69,903,300.3087	11.1206	4,493.6954	56.5819	73.4180
2005	16	Russian Federation	8,927.9136	79,707,641.2402	11.2535	4,540.9174	56.7132	73.4630
2006	16	Russian Federation	9,687.5021	93,847,697.5170	11.6691	4,688.3946	54.7334	73.5080
2007	16	Russian Federation	10,532.3356	110,930,094.0079	11.6725	4,709.8457	51.7061	73.5530
2008	16	Russian Federation	11,089.9398	122,986,765.1845	12.0145	4,823.1265	53.3825	73.5980
2009	16	Russian Federation	10,219.5304	104,438,801.5216	11.0239	4,531.2867	48.4351	73.6420
2010	16	Russian Federation	10,674.9972	113,955,565.2717	11.6943	4,819.0414	50.3555	73.6870
2011	16	Russian Federation	11,230.3991	126,121,864.8891	12.3349	5,049.4280	47.9011	73.7320
2012	16	Russian Federation	11,621.3960	135,056,845.4132	12.7850	5,167.0120	47.1096	73.7910
2013	16	Russian Federation	11,803.7195	139,327,792.9816	12.3936	5,078.6293	46.1934	73.8630
2014	16	Russian Federation	11,680.6039	136,436,508.2720	11.8575	4,942.8755	47.6989	73.9500

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	17	Saudi Arabia	20,226.8542	409,125,631.6882	16.4300	4,426.4639	75.0920	77.8510
1993	17	Saudi Arabia	19,413.7829	376,894,967.7603	17.5713	4,471.4461	67.8070	78.1860
1994	17	Saudi Arabia	19,041.0584	362,561,904.9278	16.8183	4,588.9543	60.0713	78.4290
1995	17	Saudi Arabia	18,648.8569	347,779,862.4488	12.5514	4,510.4166	65.0418	78.6700
1996	17	Saudi Arabia	18,744.7805	351,366,796.5380	13.5248	4,728.2282	66.6539	78.9100
1997	17	Saudi Arabia	18,588.3043	345,525,058.4366	11.0860	4,422.5365	65.1881	79.1470
1998	17	Saudi Arabia	18,763.5859	352,072,156.8846	10.4454	4,623.7045	56.0884	79.3830
1999	17	Saudi Arabia	17,690.9176	312,968,564.4253	11.1587	4,611.6198	57.8461	79.6160
2000	17	Saudi Arabia	18,263.2301	333,545,573.0214	14.3003	4,712.7437	68.1665	79.8480
2001	17	Saudi Arabia	17,585.3905	309,245,957.4537	13.9514	4,715.1321	63.5606	80.0770
2002	17	Saudi Arabia	16,619.4347	276,205,608.3859	14.9001	5,078.4989	64.5928	80.3040
2003	17	Saudi Arabia	17,954.9498	322,380,222.0937	14.5091	4,990.7701	69.8312	80.5300
2004	17	Saudi Arabia	18,822.7300	354,295,166.2038	17.0406	5,157.4804	75.0828	80.7540
2005	17	Saudi Arabia	19,309.3121	372,849,532.5034	16.6338	5,126.3414	81.9541	80.9790
2006	17	Saudi Arabia	19,304.5502	372,665,659.6519	17.6065	5,525.0184	89.9446	81.2040
2007	17	Saudi Arabia	19,136.1592	366,192,590.2115	15.3560	5,556.7134	94.8633	81.4270
2008	17	Saudi Arabia	19,792.7204	391,751,780.1855	16.5830	6,034.5233	96.1026	81.6490
2009	17	Saudi Arabia	18,861.1100	355,741,470.3716	17.5896	6,250.3281	84.8583	81.8670
2010	17	Saudi Arabia	19,259.5873	370,931,701.3041	18.9053	6,763.3369	82.5498	82.0840
2011	17	Saudi Arabia	20,575.4980	423,351,115.9166	17.7023	6,307.8921	85.5435	82.3020
2012	17	Saudi Arabia	21,056.3471	443,369,755.1843	19.4195	6,888.0664	83.5118	82.5200
2013	17	Saudi Arabia	21,005.0121	441,210,534.2730	18.0684	6,417.9171	82.7091	82.7400
2014	17	Saudi Arabia	21,183.4649	448,739,184.6408	19.5293	6,937.2307	80.6405	82.9600

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	18	Turkey	6,932.1247	48,054,353.0690	2.7464	961.9322	31.7374	60.5180
1993	18	Turkey	7,343.3311	53,924,512.2723	2.8089	1,004.1372	33.0171	61.0550
1994	18	Turkey	6,889.8170	47,469,578.1793	2.7248	976.4890	41.7459	61.5900
1995	18	Turkey	7,315.4131	53,515,269.4562	2.9404	1,052.6997	44.2426	62.1230
1996	18	Turkey	7,731.4252	59,774,934.9694	3.1672	1,126.1820	49.3693	62.6530
1997	18	Turkey	8,186.5064	67,018,886.8398	3.2885	1,166.2288	54.9703	63.1790
1998	18	Turkey	8,244.7580	67,976,033.8961	3.2711	1,169.8820	40.2743	63.7030
1999	18	Turkey	7,842.8442	61,510,204.7829	3.1591	1,131.0924	37.4017	64.2230
2000	18	Turkey	8,237.6117	67,858,246.0483	3.4179	1,201.0873	42.0005	64.7410
2001	18	Turkey	7,631.6517	58,242,107.5437	3.0308	1,094.1977	49.3988	65.3400
2002	18	Turkey	8,003.7333	64,059,746.4843	3.1574	1,139.3925	47.4605	65.9740
2003	18	Turkey	8,332.0291	69,422,708.2825	3.3067	1,178.4439	45.6015	66.6020
2004	18	Turkey	9,009.8815	81,177,963.8184	3.3641	1,204.7219	48.1197	67.2250
2005	18	Turkey	9,692.1288	93,937,360.8328	3.4960	1,240.1664	45.4371	67.8400
2006	18	Turkey	10,251.3814	105,090,820.8782	3.8046	1,354.6771	48.1511	68.4500
2007	18	Turkey	10,638.0661	113,168,449.9586	4.0901	1,436.8447	47.2896	69.0530
2008	18	Turkey	10,599.6304	112,352,165.6524	4.0315	1,401.3491	49.9063	69.6510
2009	18	Turkey	9,973.6648	99,473,989.8018	3.8947	1,370.7885	45.9325	70.2410
2010	18	Turkey	10,672.4004	113,900,129.5405	4.1202	1,474.6697	45.8992	70.8250
2011	18	Turkey	11,683.6051	136,506,628.2940	4.3706	1,546.2033	52.6629	71.4020
2012	18	Turkey	12,052.7184	145,268,019.6403	4.4195	1,585.4002	52.2453	71.9740
2013	18	Turkey	12,866.0943	165,536,383.4699	4.2853	1,542.9682	50.3503	72.5310
2014	18	Turkey	13,312.4518	177,221,373.5653	4.4915	1,577.8280	51.4141	73.0770

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	19	United States	36,566.1738	1,337,085,064.1671	19.1394	7,677.4014	19.8927	76.0970
1993	19	United States	37,078.0497	1,374,781,768.3647	19.3471	7,709.4966	19.9859	76.4880
1994	19	United States	38,104.9725	1,451,988,926.7537	19.3609	7,757.8308	20.9935	76.8750
1995	19	United States	38,677.7151	1,495,965,644.4568	19.2765	7,763.7551	22.3822	77.2570
1996	19	United States	39,681.5199	1,574,623,018.2332	19.4960	7,844.4683	22.6112	77.6360
1997	19	United States	40,965.8466	1,678,200,591.3459	19.6904	7,828.5811	23.3441	78.0080
1998	19	United States	42,292.8912	1,788,688,646.1517	19.5792	7,803.6976	22.7597	78.3770
1999	19	United States	43,768.8850	1,915,715,293.5158	19.7272	7,923.2239	23.1930	78.7420
2000	19	United States	45,055.8179	2,030,026,728.2856	20.1788	8,056.8638	24.9832	79.0570
2001	19	United States	45,047.4872	2,029,276,102.8255	19.6365	7,827.8863	22.8031	79.2340
2002	19	United States	45,428.6457	2,063,761,848.1488	19.6134	7,843.3448	22.1497	79.4090
2003	19	United States	46,304.0361	2,144,063,758.1834	19.5641	7,794.2355	22.4506	79.5830
2004	19	United States	47,614.2799	2,267,119,646.7937	19.6584	7,881.5786	24.2949	79.7570
2005	19	United States	48,755.6161	2,377,110,097.4558	19.5919	7,846.4997	25.5007	79.9280
2006	19	United States	49,575.4010	2,457,720,385.6584	19.0941	7,697.6525	26.8736	80.0990
2007	19	United States	49,979.5338	2,497,953,803.1555	19.2179	7,758.1660	27.9589	80.2690
2008	19	United States	49,364.6446	2,436,868,131.5512	18.4618	7,488.0819	29.9414	80.4380
2009	19	United States	47,575.6086	2,263,438,530.1159	17.1577	7,056.7837	24.7658	80.6060
2010	19	United States	48,466.8210	2,349,032,740.2509	17.4429	7,161.4510	28.0580	80.7720
2011	19	United States	48,862.4226	2,387,536,339.8413	16.9770	7,030.0329	30.7893	80.9440
2012	19	United States	49,596.4195	2,459,804,828.4328	16.3105	6,872.1027	30.5682	81.1190
2013	19	United States	50,161.0734	2,516,133,283.5025	16.3235	6,905.6471	30.0130	81.2990
2014	19	United States	51,015.1330	2,602,543,795.2932	16.5028	6,960.6820	29.9645	81.4830

Year	Aid	Country	GDP	GDP2	CO2	EC	TO	UP
1992	20	South Africa	5,488.1747	30,120,061.3191	7.6648	2,250.6491	37.4875	53.0380
1993	20	South Africa	5,426.2907	29,444,630.5429	7.9665	2,355.7710	39.1233	53.5210
1994	20	South Africa	5,475.1135	29,976,868.2164	8.2285	2,381.6355	40.7690	54.0040
1995	20	South Africa	5,528.2566	30,561,620.9060	8.6072	2,460.1586	43.6109	54.4860
1996	20	South Africa	5,657.0521	32,002,238.4421	8.4945	2,466.5100	46.6673	54.9670
1997	20	South Africa	5,703.2936	32,527,557.9834	8.8447	2,489.1691	46.8453	55.4490
1998	20	South Africa	5,639.4379	31,803,260.3891	8.5127	2,433.0530	48.8966	55.9300
1999	20	South Africa	5,686.7807	32,339,475.0899	8.3277	2,424.9334	46.8619	56.4110
2000	20	South Africa	5,838.8645	34,092,338.8931	8.2808	2,384.5481	51.4378	56.8910
2001	20	South Africa	5,911.6185	34,947,233.4752	8.0208	2,417.8526	54.8016	57.3680
2002	20	South Africa	6,046.7879	36,563,644.4016	7.5838	2,339.7631	59.7646	57.8980
2003	20	South Africa	6,143.7784	37,746,012.4499	8.4884	2,469.2055	51.4018	58.4460
2004	20	South Africa	6,343.8940	40,244,991.6297	9.3308	2,662.4835	51.0780	58.9930
2005	20	South Africa	6,600.2523	43,563,330.0629	8.5398	2,626.9814	53.1491	59.5360
2006	20	South Africa	6,893.3066	47,517,675.9379	9.0732	2,579.2456	60.2773	60.0770
2007	20	South Africa	7,186.7381	51,649,204.7402	9.3527	2,732.9179	63.6831	60.6160
2008	20	South Africa	7,338.8458	53,858,657.5539	9.8542	2,913.1301	72.8654	61.1540
2009	20	South Africa	7,146.7643	51,076,239.3485	9.8706	2,824.4644	55.4183	61.6870
2010	20	South Africa	7,276.3768	52,945,658.7003	9.1907	2,748.3635	55.9890	62.2180
2011	20	South Africa	7,417.7281	55,022,689.7179	9.0040	2,703.1789	60.1126	62.7460
2012	20	South Africa	7,476.8032	55,902,585.7140	8.8450	2,628.4483	60.8997	63.2720
2013	20	South Africa	7,552.9972	57,047,767.2290	8.6740	2,598.9597	64.2418	63.7930
2014	20	South Africa	7,583.5895	57,510,829.8350	8.9801	2,695.7338	64.4345	64.3120

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