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The Effect of the Kyoto Protocol on Developed and Developing Countries

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Abstract

In this study, the relationship between income and environmental degradation is discussed. In this study, the Kyoto Protocol is investigated by using Pooled Mean Group Estimator based on Error Correction Model by Pesaran, Shin and Smith, Cross-Sectional Augmented Distributed Lag estimator by Chudik et al. (2016), Cross-Sectional ARDL estimator based on ARDL model by Chudik et al. (2016) and Dynamic Common Correlated Effects Estimator model by Chudik and Pesaran (2015) to cover the gaps in the Environmental Kuznets Curve literature. Kyoto Protocol's effects for developing countries and developed countries are analyzed for the period between 1980 and 2014, and 1971 and 2014, respectively. Since no significant relationship between GDP and CO2 is found for developed and developing countries in the analysis, it is concluded that Kyoto Protocol did not have a significant effect on CO2 emissions for the relevant countries in the study. This study contributes to the current literature by verifying no significant effect of Kyoto Protocol on CO2 emissions as compatible with most up-to-date studies. The limitations of this study are the studied countries and the period studied for these studied countries.

Keywords: Kyoto Protocol; Environmental Kuznets Curve; Developing Countries; Developed Countries; Economic Growth
JEL Classifications: Q4, Q5, O5

I. Introduction

In this study, the Kyoto Protocol is investigated by using Pooled Mean Group Estimator based on Error Correction Model (PEC) by Pesaran et al. (1999), Cross-Sectional Augmented Distributed Lag estimator (CS-DL) by Chudik et al. (2016), Cross-Sectional ARDL estimator based on ARDL model (CS-ARDL) by Chudik et al. (2016) and Dynamic Common Correlated Effects Estimator model (DCC-EE) by Chudik and Pesaran (2015) to cover the gaps in the EKC literature.

Environmental Kuznets Curve (EKC) is a topic to analyze the relationship between environmental degradation and income. EKC literature started in the early 1990s and continues to be studied today. It is still an important topic since sustainability studies are one of the hot topics today. EKC hypothesis states that as income increases till a point environmental degradation increases with income. However, after that point, which is a peak, as income increases environmental degradation decreases. Researchers work on the relationships between income and environmental degradation by using different econometric techniques to analyze whether environmental Kuznets curve exist or not. By today, the literature about whether environmental Kuznets curve exist or not is inconclusive. Researchers continue their studies by taking different measures for environmental degradation and adding new variables to the relationship between income and environmental degradation.

In this study, EKC hypothesis is analyzed for different countries by using econometric techniques. The econometric techniques used for the study are not used for the studied countries in the literature. The main questions in this study are as below:

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The question investigated in this study whether Kyoto Protocol has a significant effect on CO2 emissions.

Climate change is a topic worldwide discussed by scientists, politicians, and individuals. Carbon dioxide is also discussed besides climate change since it is one of the major causes for climate change and one of main greenhouse gas emissions (GHE) which are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. To cope with climate change and reduce CO2, many initiatives take place on individual country level and global level. For global initiatives Paris Agreement (PA) and Kyoto protocol (KP) can be mentioned as two of them.

KP, as being one of the global initiatives, an international agreement which was signed and ratified with different parties on December 11, 1997 is one of the main efforts of humanity to cope with climate change and reduce CO2 emissions. Developing and developed countries aim to reduce their GHE by taking place in global initiatives. The protocol was prepared under the guidance of United Nations Framework Convention on Climate Change (UNFCC). It was first started with 37 industrialized countries and the European Union but today almost all countries involved in the protocol. Not all countries ratified KP such as United States of America (USA). Kyoto Protocol went into practice by 2005 and by having a common objective for GHE reduction, it also provided each participant country with a different commitment for emissions.

KP's first commitment period for ratified parties was between 2008 and 2012. First commitment period required involved countries to reduce their GHE by 5 percent below 1990 levels. Updates to protocol were made in 2011 in Morocco and in 2012 in Qatar. After 2012 meeting in Qatar, second commitment period was decided to be started between 2013 and end of 2020. New common objective was to reduce GHE 18 percent below 1990 levels. Many discussions take place in the media and scientific community whether Kyoto Protocol is successful and its contribution to the reduction level in CO2 and GHE worldwide.

KP was not created just being a binding agreement by participant countries and the United Nations, but it was also created to set up new initiatives to cope with GHE against climate change. These initiatives are carbon trading, Clean Development Mechanism and Joint Implementation. The main common point of these initiatives is the participant countries in the KP can trade their excess carbon allowance on the carbon market and gain income. Also, in clean development mechanism, a participant country can make a green investment inside its borders to gain carbon credits to count in further commitment periods toward its emissions allowances. In joint implementation, a participant country can make a green investment in another country's territory to gain carbon credits to count in further commitment periods toward its emissions allowances.

KP is discussed besides EKC, which states income increase with CO2 to a certain level and after that level is reached CO2 starts to decrease while income increases, as well as climate change. The impact of KP on EKC is one of the determinants for countries that are involved in the protocol to determine their policy implications towards their coping strategy with climate change. This study investigated the effect of KP on emissions by dividing the period between 1971 and 2014 into 1971-1997 and 1997-2014. The effect of KP is analyzed within 1997-2014. The EKC hypothesis is taken as basis to analyze the effect of KP on emissions. Increase in economic development is expected to further decrease in emissions within this period. Energy consumption is also added to the analysis to analyze the effect of energy consumption on emissions and to further analyze the related policies for energy consumption's effect on emissions.

In this study the effect of the KP on developing countries are examined for Argentina, Egypt, Ghana, India, Iran, Kenya, Malaysia, Morocco, Nigeria, and Turkey. The effect of the KP on developed countries are examined for Sweden, Denmark, Australia, Portugal, Austria, Canada, Finland, Spain, and UK. Final parts of this study are discussion and conclusion parts. In discussion and conclusion parts, overall findings of the study are discussed.

For the latest study in the literature for the effect of KP on emissions (Butler & Ponce, 2020) analyzed the effect of KP on emissions for the period 2005 and 2012 and concluded that KP prevented further increase in emissions but did not decrease the total amount of emissions which is compatible with the overall consensus in the literature.

II. Literature Review

Impact of the KP studies in the literature of carbon Kuznets curve is discussed in part 2.1. Single country studies in the literature of carbon Kuznets curve is discussed in part 2.2. Majority of the studies in the EKC literature analyzed multi-country studies and panel studies.

Impact of the KP studies in the literature of Carbon Kuznets Curve

Grunewald and Martinez-Zarzoso (2016) analyzed the impact of the KP on CO2 emissions for 170 countries over the period 1992 and 2009. They found that ratifying KP had a significant effect on CO2 emissions and countries emit on average 7% less emissions that signed the protocol than those without.

Aichele and Felbermayr (2013) found that KP had a statistically significant negative effect on CO2 emissions. The effect is close to 10 percent on CO2 emissions for panel countries. Halkos and Tzeremes (2014) applied conditional full frontiers approach to analyze KP's effect on CO2 emissions for a panel of 110 countries. They found a nonlinear relationship between the countries' duration in the protocol and their emission levels. They also found a nonlinear relationship between countries' agreement on emission level and their emission levels.

Kumazawa and Callaghan (2012) analyzed the impact of KP on CO2 emissions for a panel of 177 countries for the period 1980 and 2006. They found structural breaks in the analysis of data which they mentioned as the effects of KP. Panel version of Chow test is used. They also found that emissions decreased by increasing income in Annex B countries which signed the KP. They also found industrial production negatively affected emissions in both Annex-B and non-Annex-B countries. Mert and Çağlar (2017) analyzed the impact of KP for 26 countries for the period 1960 and 2013 by using structural breaks. They found structural breaks between 1997 and 2006 for 19 countries in the study and mentioned them as the impact of KP.

A study examined the effect of KP by comparing the Kyoto Protocol scenario with no-Kyoto Protocol scenario. While Maamoun confirmed that the emission levels would be higher without the Protocol, Almer and Winkler found that there were no difference between the Kyoto Protocol scenario and no-Kyoto Protocol scenario (Maamoun, 2019; Almer & Winkler, 2017).

Butler and Ponce (2020) analyzed the effect of KP on emissions for the period 2005 and 2012 and concluded that KP prevented further increase in emissions but did not decrease the total amount of emissions which is compatible with the overall consensus in the literature.

Single country studies in the literature of Carbon Kuznets Curve

Kunnas and Myllyntaus (2007) analyzed EKC hypothesis for CO2 emissions in Finland. Kunnas and Myllyntaus did not confirm EKC hypothesis for the period 1800 and 2003. Urban and Nordensvärd (2018) confirmed EKC hypothesis for overall CO2 emissions and CO2 per capita emissions in Sweden. Marques et al. (2018) examined the relationship between CO2 and GDP in Australia. Marques et al. confirmed EKC hypothesis in Australia for the period 1965 and 2016 by ARDL methodology.

Halicioglu and Ketenci (2016) examined EKC hypothesis in Estonia for the period 1991 and 2013 by ARDL and GMM methodology. Halicioglu and Ketenci confirmed the EKC hypothesis in Estonia by ARDL and GMM methodologies for the period 1991 and 2013. Hasson and Masih (2017) examined the EKC hypothesis in South Africa for the period 1971 and 2013 by ARDL methodology. Hasson and Masih (2017) confirmed the EKC hypothesis in South Africa.

Sarkodie and Strezov (2018) confirmed the EKC hypothesis in China and Australia **(**Dong et al., 2018; Cohen et al., 2019; Song et al., 2019; Zhou et al., 2019; He & Lin, 2019) confirmed the EKC hypothesis in China. While few studies confirmed N-shaped EKC relationship in China (Du et al., 2018; Hao et al., 2018). Song et al. (2019) confirmed the EKC hypothesis in USA. However**,** Gui et al. (2019) did not confirm the EKC relationship for waste in China.

For analysis of relationship between coal consumption and economic development, Chai et al. (2019) did not confirm the coal Kuznets curve in China.

Shahbaz and Sinha (2019)**,** Purcel (2020) and Pincheira and Zuniga (2020) are the most recent literature reviews for environmental Kuznets curve studies. While Shahbaz and Sinha (2019) and Pincheira and Zuniga (2020) suggested new econometric techniques to be used for further studies in the literature, Purcel (2020) suggested that developing countries should put more efforts for the combat against climate change.

Study of Kunnas and Myllyntaus (2007) is the major study of EKC hypothesis in Finland in the literature.

Study of Halicioglu and Ketenci (2016) is the major study in Estonia for EKC hypothesis.

Literature review shows that the effect of KP on emissions is analyzed within the EKC hypothesis and new econometric techniques are needed to be applied for further analysis for the effect of KP on emissions.

III. Methodology and Data of the Study

Data used in the study is explained in part 3.1. Methodology of the study is discussed in part 3.2. Methodology is explained in detail for each chapter.

Data

GDP is gross domestic product per capita. CO2 is carbon dioxide emissions per capita. ENEGE is energy consumption (kg of oil equivalent per capita). SQ is the square of gross domestic product. Data for CO2, GDP, SQ and ENEGE is retrieved from World Bank website.

For panel data analysis, cross sectional dependency is tested in panel data. First generation panel unit root tests do not take cross sectional dependency into consideration. Since cross sectional dependency is found in panel data, second generation panel unit root tests are used. First generation panel unit root tests which are Im et al. (2003) and Levin et al. (2002) panel unit root tests are also used in the study. For second generation panel unit root tests, Pesaran (2004) cross section dependency test (P-CSD test) and Pesaran (2015) weak cross sectional dependency test (PW-CSD test) are used. Panel cointegration test is optional so Westerlund (2007) Error Correction Based Bootstrap Panel Cointegration Test (W-ECB test) is applied only for developing countries for the period between 1971 and 1997 for CO2-GDP-SQ-ENEGE nexus and CO2-GDP-SQ nexus separately. Hausman (1978) test is applied first to decide between fixed effects and random effects model, then Hausman test is again applied to decide between mean group model and pooled mean group model.

$$\ln(\boldsymbol{CO2})_t = \boldsymbol{r_0} + \boldsymbol{r_1}\ln(\boldsymbol{GDP})_t + \boldsymbol{r_2}\ln(\boldsymbol{GDP})_t^{\,2} + \boldsymbol{r_3}\ln(\boldsymbol{ENEGE})_t + \boldsymbol{e_t} \quad (1)$$

$$\ln(\boldsymbol{CO2})_t = \boldsymbol{r_0} + \boldsymbol{r_1}\ln(\boldsymbol{GDP})_t + \boldsymbol{r_2}\ln(\boldsymbol{GDP})_t^{\,2} + \boldsymbol{e_t} \quad (2)$$

For all models e is the error term and $\boldsymbol{r_0}$, $\boldsymbol{r_1}$, $\boldsymbol{r_2}$ and $\boldsymbol{r_3}$ are coefficients.

For developing countries for the period between 1971 and 1997, Hausman test is applied separately for CO2-GDP-SQ-ENEGE nexus and CO2-GDP-SQ nexus. CS-ARDL and CCE-PMG are applied for CO2-GDP-SQ nexus, and CS-DL model is applied for CO2-GDP-SQ-ENEGE nexus.

DCC-EE by Chudik and Pesaran is used since there is cross sectional dependency in the data. For a dynamic model, there are three models that are used to estimate the long run coefficients. First one is PEC by Pesaran, Shin and Smith. Second one is CS-DL by Chudik, et al. (2016) which estimates long run coefficients directly from a dynamic model. Third one is CS-ARDL by Chudik, et al. (2016) which first estimates short run coefficients then long run coefficients from a dynamic model. Although Hausman test results indicate pooled mean group model, since there is cross sectional dependency in panel data, all three models are used. All three models provide cross sectional dependency test results. At the end of the analysis, cross sectional dependency test results are also checked for that there is no cross-sectional dependency in the analysis.

For developed countries between 1971 and 1997, CS-ARDL model is not applied. CCE-PMG models and CS-DL models are applied for CO2-GDP-SQ-ENEGE nexus.

IV Results

Effect of KP on Developing Countries

CO2-GDP-SQ-ENEGE nexus is examined for the developing countries for the period between 1971 and 1997, and for the period between 1997 and 2014. Developing countries are Argentina, Egypt, India, Iran, Kenya, Malaysia, Morocco, Nigeria, and Turkey. DCC-EE, CS-DL, and CS-ARDL models are used in this chapter.

Developing Countries CO2-GDP-SQ-ENEGE Nexus Between 1971 and 1997

Cross-sectional dependency tests are applied. According to cross-sectional dependency tests, there is cross-sectional dependency in panel data (see Table 1, Table 2, and Table 3). First generation panel unit root tests are applied. According to results, all variables are at I(1) level (see Table 4 and Table 5). Since cross-sectional dependency exists in panel data, second generation panel unit root test (UR) are applied (see Table 6 and Table 7). Westerlund cointegration test is applied to examine the cointegration between the variables. According to Westerlund cointegration test, there is no long-run relationship between the variables (see Table 8). Since cointegration test is optional, further analysis is applied. Hausman test is applied to test between fixed effect and random effect (see Table 9). After random effect is chosen as appropriate model, hausman test is applied again to decide between mean group and pooled mean group (see Table 10). CS-ARDL, CCE-PMG and CS-DL models are applied. According to CS-ARDL model results, although cointegration exists between the variables, EKC hypothesis is not confirmed for panel countries (see Table 11). According to CCE-PMG model results, no cointegration exists between the variables and EKC hypothesis is not confirmed for panel countries (see Table 12). According to CS-DL model results, EKC hypothesis is not confirmed for panel countries (see Table 13).

Table – 1: P-CSD test for Developing Countries (1971 – 1997)

Variable	CD-test	p-value	Corr	absCorr
CO2	4.54	0.000	0.130	0.491
GDP	2.03	0.042	0.058	0.632
SQ	2.08	0.038	0.060	0.631
ENEGE	18.96	0.000	0.544	0.633

Table – 2: PW-CSD test for Developing Countries (1971 – 1997)

Variable	CD	P-Value
CO2	-1.854	0.064
GDP	34.833	0.000
SQ	34.761	0.000
ENEGE	34.838	0.000

Table – 3: P-CSD and PW-CSD tests for Developing Countries (1971 – 1997)

Variable	CD-Test	P-Value	Average Joint T	Mean P	Mean abs (p)
CO2	4.535	0.000	27.00	0.13	0.49
GDP	2.035	0.042	27.00	0.06	0.63
SQ	2.077	0.038	27.00	0.06	0.63
ENEGE	18.96	0.000	27.00	0.54	0.63

Table – 4: Im-Pesaran-Shin UR Results for Developing Countries (1971 – 1997)

	Level		First Difference	
Variable	Statistics	P-Value	Statistic	P-Value
C02	1.9569	0.9748	-8.9322	0.0000
GDP	2.2245	0.9869	-6.5064	0.0000
SQ	2.4575	0.9930	-6.4167	0.0000
ENEGE	1.1465	0.8742	-7.1331	0.0000

Table – 5: Levin-Lin-Chu UR Results for Developing Countries (1971 – 1997)

	Level		First Difference	
	Statistics	P-Value	Statistic	P-Value
C02	1.2348	0.8915	-7.9976	0.0000
GDP	0.1210	0.5482	-5.2594	0.0000
SQ	0.4546	0.6753	-5.1705	0.0000
ENEGE	-0.0957	0.4619	-6.8764	0.0000

Table – 6: Pesaran (2007) Panel UR for Developing Countries (1971 – 1997)

	Level	First Difference	Critical Values		
Variable	CIPS	CIPS	10%	5%	1%
CO2	-1.492	-5.246	-2.21	-2.33	-2.57
GDP	-1.261	-4.180	-2.21	-2.33	-2.57
SQ	-1.222	-4.169	-2.21	-2.33	-2.57
ENEGE	-2.069	-4.564	-2.21	-2.33	-2.57

Table – 7: Pesaran (2003) Panel UR for Developing Countries (1971 – 1997)

	Level			First Difference			Critical Values		
Variable	t-bar	Z-t-bar	P-Value	t-bar	Z-t-bar	P-Value	10%	5%	1%
CO2	-1.291	1.529	0.937	-3.919	-7.037	0.000	-2.210	-2.330	-2.570
GDP	-1.118	2.092	0.982	-3.279	-4.593	0.000	-2.210	-2.330	-2.570
SQ	-1.059	2.286	0.989	-3.226	-4.780	0.000	-2.210	-2.330	-2.570
ENEGE	-2.329	-1.855	0.032	-3.839	-6.778	0.000	-2.210	-2.330	-2.570

Table – 8: W-ECB Test for Developing Countries (1971 – 1997)

CO2-GDP-SQ-ENC Nexus				
Statistic	Value	Z-Value	P-Value	Robust P-Value
Gt	-1.611	0.305	0.620	0.387
Ga	-4.775	1.537	0.938	0.310
Pt	-5.285	-0.855	0.196	0.240
Pa	-2.775	0.748	0.773	0.520
CO2-GDP-SQ Nexus				
Statistic	Value	Z-Value	P-Value	Robust P-Value
Gt	-1.861	-1.448	0.074	0.077
Ga	-5.149	0.390	0.652	0.143
Pt	-6.125	-2.379	0.009	0.063
Pa	.-4.330	-1.181	0.119	0.160

Table – 9: W-ECB Test for Developing Countries (1971 – 1997)

CO2-GDP-SQ-ENEGE Nexus	
Chi2(3)	Prob
0.61	0.8932
CO2-GDP-SQ Nexus	
Chi2(2)	Prob
2.09	0.3513

Table – 10: Hausman Test for MG vs. PMG for Developing Countries (1971 – 1997)

CO2-GDP-SQ-ENEGE Nexus	
Chi2(3)	Prob
1.57	0.6670
CO2-GDP-SQ Nexus	
Chi2(2)	Prob
2.67	0.2631

Table – 11: Short-run Results (SRR) and Long-run Results (LRR) for CS-ARDL for Developing Countries (1971 – 1997)

CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf.	Interval]
SRR Estimates						
MG						
L.CO2	0.1409255	0.1268518	1.11	0.267	-0.1076994	0.3895505
GDP	-17.01414	13.32609	-1.28	0.202	-43.13279	9.104514
SQ	1.323612	0.9848225	1.34	0.179	-0.6066045	3.253829
L.GDP	30.88922	23.01034	1.34	0.179	-14.21022	75.98866
L2.GDP	4.545223	7.737622	0.59	0.557	-10.62024	19.71068
L.SQ	-2.207253	1.701578	-1.30	0.195	-5.542286	1.127779
L2.SQ	-0.3855183	0.5198035	-0.74	0.458	-1.404314	0.6332779
LRR Estimates						
MG						
LR_CO2	-0.8590745	0.1268518	-6.77	0.000	-1.107699	-0.6104495
LR_GDP	38.73629	29.37179	1.32	0.187	-18.83137	96.30394
LR_SQ	-2.642682	2.112223	-1.25	0.211	-6.782563	1.497199
CD Statistic	-1.81	P-Value	0.0701			

Table – 12: SRR and LRR Results for CCE-PMG for Developing Countries (1971 – 1997)

D.CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
SRR Estimates						
MG						
D.GDP	-36.9613	23.96122	-1.54	0.123	-83.92442	10.00183
D2.GDP	28.58131	24.15473	1.18	0.237	-18.76109	75.9237
D.SQ	2.718548	1.724587	1.58	0.115	-0.6615807	6.098677
D2.SQ	-2.133922	1.793342	-1.19	0.234	-5.648808	1.380964
LRR Estimates						
Pooled						
L.CO2	-0.7003947	0.538322	-1.30	0.193	-1.755486	0.354697
GDP	1.657057	17.78836	0.09	0.926	-33.20749	36.5216
SQ	-0.0561204	1.266682	-0.04	0.965	-2.538771	2.42653
CD Statistic	-1.59	P-Value	0.1121			

Table – 13: LRR Results for CS-DL (CCE-MG (Common Correlated Effects Mean Group)) for Developing Countries (1971 – 1997**)**

CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
MG						
GDP	-27.99055	20.98552	-1.33	0.182	-69.12141	13.1403
SQ	2.097335	1.566263	1.34	0.181	-0.9724847	5.167154
ENEGE	0.5094035	0.3937138	1.29	0.196	-0.2622613	1.281068
D.GDP	-0.1424516	0.1638132	-0.87	0.385	-0.4635196	0.1786165
LD.GDP	-0.1944285	0.0991779	-1.96	0.050	-0.3888136	-0.0000435
D.ENEGE	0.1037665	0.2724869	0.38	0.703	-0.4302981	0.6378311
LD.ENEGE	1.000028	0.5630336	1.78	0.076	-0.1034971	2.103554
CD Statistic	-1.35	P-Value	0.1784			

Developing Countries CO2-GDP-SQ-ENEGE Nexus Between 1997 and 2014

Cross-sectional dependency tests are applied. According to cross-sectional dependency tests, there is cross-sectional dependency in panel data (see Table 14, Table 15, and Table 16). First generation panel unit root tests are applied. According to results, all variables are at I (1) level (see Table 17 and Table 18). Since cross-sectional dependency exists in panel data, second generation panel unit root test are applied (see Table 19 and Table 20). Hausman test is applied to test between fixed effect and random effect (see Table 21). After random effect is chosen as appropriate model, hausman test is applied again to decide between mean group and pooled mean group (see Table 22). CS-ARDL, CCE-PMG and CS-DL models are applied. According to CS-ARDL model results, although cointegration exists between the variables, EKC hypothesis is not confirmed for panel countries (see Table 23). According to CCE-PMG model results, cointegration exists between the variables and EKC hypothesis is not confirmed for panel countries (see Table 24). According to CS-DL model results, EKC hypothesis is not confirmed for panel countries (see Table 25).

Table – 14: P-CSD test for Developing Countries (1997 – 2014)

Variable	CD-test	p-value	Corr	abs(corr)
CO2	15.24	0.000	0.535	0.576
GDP	25.88	0.000	0.909	0.909
SQ	25.89	0.000	0.910	0.910
ENEGE	17.02	0.000	0.598	0.759

Table – 15: PW-CSD for Developing Countries (1997 – 2014)

Variable	CD	P-Value
CO2	2.105	0.035
GDP	28.457	0.000
SQ	28.446	0.000
ENEGE	28.455	0.000

Table – 16: P-CSD and PW-CSD tests for Developing Countries (1997 – 2014)

Variable	CD-Test	P-Value	Average Joint T	Mean P	Mean abs (p)
CO2	15.238	0.000	18.00	0.54	0.58
GDP	25.878	0.000	18.00	0.91	0.91
SQ	25.894	0.000	18.00	0.91	0.91
ENEGE	17.023	0.000	18.00	0.60	0.76

Table – 17: Im-Pesaran-Shin UR Results for Developing Countries (1997 – 2014)

	Level		First Difference	
	Statistics	P-Value	Statistic	P-Value
C02	1.5368	0.9378	-6.1165	0.0000
GDP	2.3604	0.9909	-4.7417	0.0000
SQ	2.5521	0.9946	-4.6998	0.0000
ENEGE	1.9941	0.9769	-5.2183	0.0000

Table – 18: Levin-Lin-Chu UR Results for Developing Countries (1997 – 2014)

	Level		First Difference	
	Statistics	P-Value	Statistic	P-Value
C02	-1.0196	0.1540	-10.2064	0.0000
GDP1	0.4504	0.6738	-4.0855	0.0000
GDP2	0.7472	0.7725	-4.0524	0.0000
ENEGE	-0.2552	0.3993	-3.6947	0.0001

Table – 19: Pesaran (2007) Panel UR for Developing Countries (1997 – 2014)

	Level	First Difference	Critical Values		
Variable	CIPS	CIPS	10%	5%	1%
CO2	-2.288	-3.608	-2.21	-2.34	-2.6
GDP	-1.540	-3.911	-2.21	-2.34	-2.6
GDP2	-1.475	-3.850	-2.21	-2.34	-2.6
ENEGE	-1.884	-3.531	-2.21	-2.34	-2.6

Table – 20: Pesaran (2003) Panel UR for Developing Countries (1997 – 2014)

	Level			First Difference			Critical Values		
Variable	t-bar	Z-t-bar	P-Value	t-bar	Z-t-bar	P-Value	10%	5%	1%
CO2	-2.288	-1.713	0.043	-3.608	-5.767	0.000	-2.210	-2.340	-2.600
GDP	-1.566	0.503	0.692	-2.397	-2.047	0.020	-2.210	-2.340	-2.600
GDP2	-1.509	0.678	0.751	-2.322	-1.818	0.035	-2.210	-2.340	-2.600
ENEGE	-2.069	-1.042	0.149	-2.802	-3.291	0.000	-2.210	-2.340	-2.600

Table – 21: Hausman Test for Fixed Effect vs. Random Effect for Developing Countries (1997 – 2014)

Chi2(3)	Prob
3.42	0.3307

Table – 22: Hausman Test for MG vs. PMG for Developing Countries (1997 – 2014)

Chi2(3)	Prob
2.19	0.5338

Table – 23: SRR and LRR Results for CS-ARDL for Developing Countries (1997 – 2014)

CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
SRR Estimates						
MG						
L.CO2	0.0459495	0.1217254	0.38	0.706	-0.1926279	0.2845268
GDP	45.42324	27.79935	1.63	0.102	-9.062484	99.90896
SQ	-3.123152	1.948767	-1.60	0.109	-6.942664	0.6963604
ENEGE	1.515661	0.3124788	4.85	0.000	0.9032135	2.128108
L.GDP	-17.72587	24.95869	-0.71	0.478	-66.644	31.19226
L.SQ	1.118642	1.642941	0.68	0.496	-2.101462	4.338747
L.ENEGE	-0.167479	0.294033	-0.57	0.569	-0.7437731	0.408815
LRR Estimates						
Mean Group						
LR_CO2	-0.9540505	0.1217254	-7.84	0.000	-1.192628	-0.7154732
LR_ENEGE	1.426848	0.5716276	2.50	0.013	0.3064786	2.547218
LR_GDP	26.62014	32.41587	0.82	0.412	-36.91379	90.15408
LR_SQ	-1.901189	2.329932	-0.82	0.415	-6.467771	2.665394
CD Statistic	1.21	P-Value	0.2271			

Table – 24: SRR and LRR Results for CCE-PMG for Developing Countries (1997 – 2014)

D.CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
SRR Estimates						
MG						
D.GDP	21.931	10.37159	2.11	0.034	1.603046	42.25895
D.SQ	-1.456899	0.6689874	-2.18	0.029	-2.76809	0.1457078
D.ENEGE	0.5992738	0.1858947	3.22	0.001	0.2349268	0.9636207
LRR Estimates						
Pooled						
L.CO2	-0.5447766	0.2290375	-2.38	0.017	-0.9936819	-0.0958714
GDP	4.341269	16.90868	0.26	0.797	-28.79913	37.48167
SQ	-0.2528071	1.152087	-0.22	0.826	-2.510856	2.005242
ENEGE	1.185402	0.4793763	2.47	0.013	0.2458416	2.124962
CD Statistic	-1.13	P-Value	0.2578			

Table – 25: LRR Results for CS-DL (CCE-MG) for Developing Countries (1997 – 2014)

CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
MG						
GDP	30.72245	32.02246	0.96	0.337	-32.04042	93.48531
SQ	-2.199211	2.305576	-0.95	0.340	-6.718056	2.319634
ENEGE	1.444556	0.5072624	2.85	0.004	0.4503397	2.438772
D.GDP	-0.7209948	0.4066496	-1.77	0.076	1.518013	0.0760238
D.ENEGE	-0.0455901	0.2903816	-0.16	0.875	-0.6147276	0.5235473
CD Statistic	0.24	P-Value	0.8119			

Effect of KP on Developed Countries

CO2-GDP-SQ-ENEGE nexus is examined for the developed countries for the period between 1971 and 1997, and for the period between 1997 and 2014. Developed countries are Sweden, Denmark, Australia, Portugal, Austria, Canada, Finland, Spain and UK. Dynamic common correlated effects estimator pooled mean group, cross-sectional augmented distributed lag, and cross-section ARDL models are used in this chapter.

Developed Countries CO2-GDP-SQ-ENEGE Nexus Between 1971 and 1997

Cross-sectional dependency tests are applied. According to cross-sectional dependency tests, there is cross-sectional dependency in panel data (see Table 26, Table 27, and Table 28). First generation panel unit root tests

are applied (see Table 29 and Table 30). Since cross-sectional dependency exists in panel data, second generation panel unit root test are applied (see Table 31 and Table 32). Hausman test is applied to test between fixed effect and random effect (see Table 33). After random effect is chosen as appropriate model, hausman test is applied again to decide between mean group and pooled mean group (see Table 34). CCE-PMG and CS-DL models are applied. According to CCE-PMG model results, cointegration exists between the variables and EKC hypothesis is not confirmed for panel countries (see Table 35). According to CS-DL model results, EKC hypothesis is not confirmed for panel countries (see Table 36).

Table – 26: P-CSD test for Developed Countries (1971 – 1997)

Variable	CD-test	p-value	Corr	abs(corr)
CO2	1.77	0.077	0.057	0.431
GDP	30.03	0.000	0.963	0.963
GDP2	30.02	0.000	0.963	0.963
ENEGE	18.43	0.000	0.591	0.591

Table – 27: PW-CSD test for Developed Countries (1971 – 1997)

Variable	CD	P-Value
CO2	30.861	0.000
GDP	31.176	0.000
GDP2	31.174	0.000
ENEGE	31.170	0.000

Table – 28: P-CSD and PW-CSD tests for Developed Countries (1971 – 1997)

Variable	CD-Test	P-Value	Average Joint T	Mean P	Mean abs (p)
CO2	1.766	0.077	27.00	0.06	0.43
GDP	30.03	0.000	27.00	0.96	0.96
GDP2	30.024	0.000	27.00	0.96	0.96
ENEGE	18.434	0.000	27.00	0.59	0.59

Table – 29: Im-Pesaran-Shin UR Results for Developed Countries (1971 – 1997)

	Level		First Difference	
Variable	Statistics	P-Value	Statistic	P-Value
C02	-2.0725	0.0191	-	-
GDP1	2.1539	0.9844	-5.8985	0.0000
GDP2	2.4605	0.9931	-5.8476	0.0000
ENEGE	-0.5984	0.2748	-8.1445	0.0000

Table – 30: Levin-Lin-Chu UR Results for Developed Countries (1971 – 1997)

	Level		First Difference	
Variable	Statistics	P-Value	Statistic	P-Value
C02	-1.6083	0.0539	-7.0450	0.0000
GDP1	-0.2969	0.3833	-7.8953	0.0000
GDP2	-0.1364	0.4457	-7.7625	0.0000
ENEGE	-1.5628	0.0590	-8.2798	0.0000

Table – 31: Pesaran (2007) Panel UR for Developed Countries (1971 – 1997)

	Level	First Difference	Critical Values		
Variable	CIPS	CIPS	10%	5%	1%
CO2	-2.742	-	-2.21	-2.33	-2.57
GDP	-2.091	-3.757	-2.21	-2.33	-2.57
GDP2	-2.090	-3.740	-2.21	-2.33	-2.57
ENEGE	-3.051	-	-2.21	-2.33	-2.57

Table – 32: Pesaran (2003) Panel UR for Developed Countries (1971 – 1997)

	Level			First Difference			Critical Values		
Variable	t-bar	Z-t-bar	P-Value	t-bar	Z-t-bar	P-Value	10%	5%	1%
CO2	-2.242	-1.490	0.068	-4.187	-7.506	0.000	-2.210	-2.330	-2.570
GDP	-2.248	-1.509	0.066	-3.346	-4.905	0.000	-2.210	-2.330	-2.570
GDP2	-2.243	-1.493	0.068	-3.356	-4.935	0.000	-2.210	-2.330	-2.570
ENEGE	-2.881	-3.466	0.000	-	-	-	-2.210	-2.330	-2.570

Table – 33: Hausman Test for Fixed Effect vs. Random Effect for Developed Countries (1971 – 1997)

Chi2(3)	Prob
2.82	0.4195

Table – 34: Hausman Test for MG vs. PMG for Developed Countries (1971 – 1997)

Chi2(3)	Prob
4.93	0.1768

Table – 35: SRR and LRR Results for CCE-PMG for Developed Countries (1971 – 1997)

D.CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
SRR Estimates						
MG						
D.GDP	13.79361	23.56607	0.59	0.558	-32.39503	59.98225
D2.GDP	-27.34135	21.17659	-1.29	0.197	-68.8467	14.164
D.SQ	-0.6529917	1.145117	-0.57	0.569	-2.897379	1.591396
D2.SQ	1.299643	1.026713	1.27	0.206	-0.7126783	3.311963
D.ENEGE	-0.0089477	0.2336693	-0.04	0.969	-0.4669311	0.4490358
D2.ENEGE	0.0538146	0.1435071	0.37	0.708	-0.2274541	0.3350833
LRR Estimates						
Pooled						
L.CO2	-0.9032651	0.164308	-5.50	0.000	-1.225303	-0.5812274
GDP	4.715685	8.126694	0.58	0.562	-11.21234	20.64371
SQ	-0.234794	0.4029814	-0.58	0.560	-1.024623	0.555035
ENEGE	1.135476	0.3345297	3.39	0.001	0.4798099	1.791142
CD Statistic	-1.45	P-Value	0.1463			

Table – 36: LRR Results for CS-DL (CCE-MG) for Developed Countries (1971 – 1997)

CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
MG						
GDP	-84.08684	98.52261	-0.85	0.393	-277.1876	109.0139
SQ	4.008676	4.728724	0.85	0.397	-5.259453	13.2768
ENEGE	-0.6135839	1.922031	-0.32	0.750	-4.380696	3.153528
D.GDP	-2.020389	2.547554	-0.79	0.428	-7.013502	2.972724
LD.GDP	-4.686748	5.1486	-0.91	0.363	-14.77782	5.404322
L2D.GDP	-0.4932242	1.235277	-0.40	0.690	-2.914323	1.927875
D.ENEGE	1.764938	2.457257	0.72	0.473	-3.051198	6.581074
LD.ENEGE	1.389798	1.88212	0.74	0.460	-2.29909	5.078686
L2D.ENEGE	0.8760533	1.407772	0.62	0.534	-1.883129	3.635235
CD Statistic	-1.02	P-Value	0.3091			

Developed Countries CO2-GDP-SQ-ENEGE Nexus Between 1997 and 2014

Cross-sectional dependency tests are applied. According to cross-sectional dependency tests, there is cross-sectional dependency in panel data (see Table 37, Table 38, and Table 39). First generation panel unit root tests are applied (see Table 40 and Table 41). Since cross-sectional dependency exists in panel data, second generation

panel unit root test are applied (see Table 42 and Table 43). Hausman test is applied to test between fixed effect and random effect (see Table 44). After random effect is chosen as appropriate model, hausman test is applied again to decide between mean group and pooled mean group (see Table 45). CS-ARDL, CCE-PMG and CS-DL models are applied. According to CS-ARDL model results, although cointegration exists between the variables, EKC hypothesis is not confirmed for panel countries (see Table 46). According to CCE-PMG model results, cointegration exists between the variables and EKC hypothesis is not confirmed for panel countries (see Table 47). According to CS-DL model results, EKC hypothesis is not confirmed for panel countries (see Table 48).

Table – 37: P-CSD test for Developed Countries (1997 – 2014)

Variable	CD-test	p-value	Corr	abs(corr)
CO2	17.33	0.000	0.681	0.681
GDP	22.96	0.000	0.902	0.902
SQ	22.94	0.000	0.901	0.901
ENEGE	11.70	0.000	0.460	0.495

Table: – 38 PW-CSD test for Developed Countries (1997 – 2014)

Variable	CD	P-Value
CO2	25.421	0.000
GDP	25.456	0.000
SQ	25.455	0.000
ENEGE	25.455	0.000

Table – 39: P-CSD and PW-CSD tests for Developed Countries (1997 – 2014)

Variable	CD-Test	P-Value	Average Joint T	Mean P	Mean abs (p)
CO2	17.33	0.000	18.00	0.68	0.68
GDP	22.961	0.000	18.00	0.90	0.90
SQ	22.937	0.000	18.00	0.90	0.90
ENEGE	11.697	0.000	18.00	0.46	0.49

Table – 40: Im-Pesaran-Shin UR Results for Developed Countries (1997 – 2014)

	Level		First Difference	
	Statistics	P-Value	Statistic	P-Value
C02	2.3691	0.9911	-5.5762	0.0000
GDP	-4.2540	0.0000	-	-
SQ	-4.1752	0.0000	-	-
ENEGE	2.0173	0.9782	-5.7794	0.0000

Table – 41: Levin-Lin-Chu UR Results for Developed Countries (1997 – 2014)

	Level		First Difference	
Variable	Statistics	P-Value	Statistic	P-Value
C02	4.3129	0.9653	-4.4668	0.0000
GDP	-4.4279	0.0000	-	-
SQ	-4.3941	0.0000	-	-
ENEGE	3.1410	0.9992	-4.8131	0.0000

Table – 42: Pesaran (2007) Panel UR for Developed Countries (1997 – 2014)

	Level	First Difference	Critical Values		
Variable	CIPS	CIPS	10%	5%	1%
CO2	-2.506	-	-2.21	-2.34	-2.6
GDP	-0.625	-2.636	-2.21	-2.34	-2.6
SQ	-0.616	-2.631	-2.21	-2.34	-2.6
ENEGE	-2.395	-	-2.21	-2.34	-2.6

Table – 43: Pesaran (2003) Panel UR for Developed Countries (1997 – 2014)

	Level			First Difference			Critical Values		
Variable	t-bar	Z-t-bar	P-Value	t-bar	Z-t-bar	P-Value	10%	5%	1%
CO2	-1.784	-0.158	0.437	-3.137	-4.097	0.000	-2.210	-2.340	-2.600
GDP	-1.402	0.956	0.831	-2.636	-2.639	0.004	-2.210	-2.340	-2.600
SQ	-1.380	1.018	0.846	-2.631	-2.623	0.004	-2.210	-2.340	-2.600
ENEGE	-1.673	0.165	0.565	-3.413	-4.902	0.000	-2.210	-2.340	-2.600

Table – 44: Hausman Test for Fixed Effect vs. Random Effect for Developed Countries (1997 – 2014)

Chi2(3)	Prob
5.16	0. 1603

Table – 45: Hausman Test for MG vs. PMG for Developed Countries (1997 – 2014)

Chi2(3)	Prob
1.56	0.6688

Table – 46: SRR and LRR Results for CS-ARDL for Developed Countries (1997 – 2014)

CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
SRR Estimates						
MG						
L.CO2	0.0916635	0.3228298	0.28	0.776	-0.5410712	0.7243983
L2.CO2	-0.0450127	0.1911582	-0.24	0.814	-0.4196758	0.3296504
L.GDP	-81.39829	99.87384	-0.82	0.415	-277.1474	114.3509
L.SQ	3.731951	4.570679	0.82	0.414	-5.226415	12.69032
L.ENEGE	0.0969654	0.422804	0.23	0.819	-0.7317153	0.9256461
LRR Estimates						
MG						
LR_CO2	-0.9533491	0.4688588	-2.03	0.042	-1.872295	-0.0344029
LR_ENEGE	1.323192	1.133478	1.17	0.243	-.8983836	3.544768
LR_GDP	181.4015	231.1606	0.78	0.433	-271.665	634.4681
LR_SQ	-9.182218	11.45932	-0.80	0.423	-31.64207	13.27763
CD Statistic	-1.52	P-Value	0.1292			

Table – 47: SRR and LRR Results for CCE-PMG for Developed Countries (1997 – 2014)

D.CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
SRR Estimates						
MG						
D.GDP	-42.29384	49.06348	-0.86	0.389	-138.4565	53.86882
D.SQ	2.117144	2.406189	0.88	0.379	-2.598901	6.833188
D.ENEGE	0.3857655	0.0788855	4.89	0.000	0.2311528	0.5403783
LRR Estimates						
Pooled						
L.CO2	-0.6910798	0.1443157	-4.79	0.000	-0.9739333	-0.4082262
GDP	-24.12879	41.01917	-0.59	0.556	-104.5249	56.26731
SQ	1.135826	1.949824	0.58	0.560	-2.68576	4.957411
ENEGE	1.776108	0.8370756	2.12	0.034	0.1354699	3.416746
CD Statistic	-1.77	P-Value	0.0761			

Table – 48: LRR Results for CS-DL (CCE-MG) for Developed Countries (1997 – 2014)

CO2	Coef.	Std. Err.	Z	P>IzI	[95% Conf. Interval]	
MG						
GDP	67.13724	69.76312	0.96	0.336	-69.59595	203.8704
SQ	-3.333865	3.425416	-0.97	0.330	-10.04756	3.379826
ENEGE	0.1805048	0.0827676	2.18	0.029	0.0182832	0.3427264
D.GDP	-0.0233179	0.2565432	-0.09	0.928	-0.5261333	0.4794975
D.ENEGE	1.433924	0.1643074	8.73	0.000	1.111888	1.755961
CD Statistic	-1.17	P-Value	0.2404			

V. Discussion

For the effect of KP, CS-ARDL, CCE-PMG and CS-DL methodologies are all used although results of Hausman test are in favor of random effect model since Hausman test may not be sensitive to cross-sectional dependency in the data and the studies in the literature used CS-ARDL, CCE-PMG and CS-DL when Hausman test were in favor of random effect model in the case of cross-sectional dependency in the data. 1997 date is chosen as the beginning of the effect of KP in this study. There are studies in the literature that chose 1997 date as the beginning of the effect of KP and there are studies that chose different dates other than 1997. Commencement dates are different in the literature for KP. The results of this study for the effect of Kyoto protocol are in line with the current literature that KP did not decrease the emission levels of the related countries with the protocol. Most up to date studies in the literature also stated KP only prevented the emissions to become worse that would have happened in no-KP scenario. Although studies stated the emissions would be worse in no-Kyoto scenario, there are other factors such as rising of average temperatures around the world might have helped the emissions not to get worse. The overall economic recession in the world is another factor might have helped the emissions not to get worse. Overall emissions continued to rise in the case of KP.

VI. Conclusion

The EKC hypothesis is examined in this study for developed and developing countries.
Main findings of this study are (see Table 49).

- Effect of the KP is not confirmed for developed and developing countries since the EKC hypothesis is not confirmed and no significant relationship is found between GDP and CO2.
- Energy consumption increases emissions in the long run for developing and developed countries.

Few studies examined the effect of the KP by using different methodologies (Almer & Winkler, 2017; Maamoun, 2019; Grunewald & Martinez-Zarzoso, 2016). Maamoun (2019) used the generalized synthetic control method, Almer and Winkler (2017) used the synthetic control method and Grunewald and Martinez-Zarzoso (2016) used a difference-in-differences estimator method to analyze the sample countries in their studies. Maamoun (2019) and Grunewald and Martinez-Zarzoso (2016) found that the KP was effective for preventing further emissions. Almer and Winkler (2017) found that there is no difference in emissions between the KP scenario and no-KP scenario. Prior research also confirmed that there were no reduction in emissions during the treatment of the KP (Almer & Winkler, 2017; Maamoun, 2019; Grunewald & Martinez-Zarzoso, 2016). These studies confirmed that KP did not reduce the emissions and the results of this study are in line with the most current literature for the effect of KP on emission levels.

For policy implications for developing and developed countries, countries should increase efficiency of energy technologies and maintain policies to increase alternatives to replace oil usage since energy consumption increases emissions. Incentives should be provided to increase the number of electric vehicles in the transport sector. The share of renewable energy consumption should be increased in the transport sector. The share of renewable energy consumption should be increased in the household sector as well. Energy efficiency policy for air transport should be maintained. Improving home insulation should be continued to contribute to overall energy efficiency policy. Fuel tax rates should be adjusted to contribute to overall energy efficiency policy. Vehicle incentive programs should be maintained to replace old cars with the new ones to decrease the average emission levels per car. Percentage of electricity consumption should be increased in the transport sector. Investment in energy conservation and emission reduction policies and increasing the use of natural gas in the transport sector should be maintained.

Although no significant relationship is found between economic development and emissions, other factors such as recession and increase in average temperature should be investigated with emissions. The effect

of coal consumption should be investigated alongside economic development since coal is among the highest contributors to global greenhouse gas emissions. This effect can be investigated within perspective of coal Kuznets curve which is not investigated in detail in the literature.

For future research directions, nonlinear relationships for EKC hypothesis may be analyzed since there are still gaps in the literature for nonlinear relationships for EKC hypothesis. Coal Kuznets curve may be analyzed for different countries and different regions by existing or new methodologies in the literature. Effect of external debt on emission levels within the EKC hypothesis may be analyzed in the future research especially for USA and China since effect of external debt on emission levels is not analyzed in the current literature. The limitation of this study is that further protocols may be analyzed such as PA.

For ontological and epistemological sides of this study, this study adopts a realistic ontology. Ontology is concerned with what constitutes valid knowledge and how we can obtain it. Epistemology is concerned with what constitutes reality and how we can understand existence. Purpose of this study to investigate the impact of gross domestic product and energy consumption on carbon dioxide emissions and the impact of KP on carbon dioxide emissions. The reality of the current world trend is countries are aiming to increase gross domestic product continuously and these countries are increasing energy consumption mainly in terms of fossil fuel resources to meet the energy demand to grow further. This study tests that whether increase and decrease in carbon dioxide emissions could be explained in terms of gross domestic product and energy consumption. For realistic approach, it means the truth can be captured if the right methods are used. Epistemological stance of this study is objectivism. In objectivist reality, there are universal principles and facts which are independent of any consciousness. In this study, relationships between carbon dioxide emissions, gross domestic product and energy consumption are examined by econometric methodologies by being separate from researchers. Positivism is the theoretical perspective of this study. Positivism takes into consideration only observable facts to reach knowledge. This study investigated the relationships between emission, growth and energy consumption and investigated these relationships with econometric analysis by data.

Table 49: Main Findings

Sample	Variables	Methodology	Time Period	Results
Developing Countries	CO2-GDP-SQ-ENEGE	CS-DL(CCE-MG)	1971 - 1997	No Effect of Kyoto Protocol
Developing Countries	CO2-GDP-SQ	CS-ARDL, CCE-PMG	1971 - 1997	No Effect of Kyoto Protocol
Developing Countries	CO2-GDP-SQ-ENEGE	CS-ARDL, CCE-PMG, CS-DL(CCE-MG)	1997 - 2014	No Effect of Kyoto Protocol
Developed Countries	CO2-GDP-SQ-ENEGE	CCE-PMG, CS-DL(CCE-MG)	1971 - 1997	No Effect of Kyoto Protocol
Developed Countries	CO2-GDP-SQ-ENEGE	CS-ARDL, CCE-PMG, CS-DL(CCE-MG)	1997 - 2014	No Effect of Kyoto Protocol

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