The Impact of Economic Growth, Energy, and Financial Sector Development on the Environmental Quality; Evidence from the Developed and Developing Countries

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ABSTRACT

This thesis investigates estimates finance induced Environmental Kuznets Curve hypothesis in order to put forward empirical relationship between carbon dioxide emissions and financial development. Annual data ranging from 1960 to 2011 has been employed to both time series and panel setting for developed and developing countries. Results from both time series and panel data analyses suggest that carbon dioxide emissions in developed and developing countries are in long-term equilibrium relationship; trade and finance sectors have long-term significant impact on carbon emissions and therefore carbon emissions converge to their long-term equilibrium levels through the channels of finance and trade sectors. However, speed of adjustment is different across countries and financial expansion is negatively related to carbon emissions. Impulse response analyses prove that finance and trade sectors have negative (reducing) impact on the emissions levels in the case of developed economies while they have positive impact in the case of developing economies. This supports the reality that developed countries are more successful in adapting energy conservation policies than developing countries. Therefore, authorities in developing countries need to adapt conservation policies effectively in order to prevent increases in emissions levels through expansion in financial and trade sectors.

Keywords: CO2 Emissions; Energy; Income; Financial Development; International Trade.

ÖZ

Bu tez, finansal büyüme değişkenini "Çevresel Kuznets Eğrisi" modeline ekleyerek gelişmiş ve gelişmekte olan devletlerin karbondioksit emisyonları ve reel gelir, enerji tüketimi, finansal gelişme, ve ticaret gibi makro ekonomik büyüklükler arasındaki amprik ilişkiyi araştırır. 1960 ve 2011 yılları arasındaki yıllık veriler kullanılarak kul- lanılarak zaman serisi verileri ve panel verileri oluşturuldu. Zaman serisi veri analizinin ve panel veri analizinin neticeleri, finansal büyüme ve ticaret sektörünün karbondioksit emisyonu üzerindeki uzun dönem etkisi birtakım gelişmiş ve gelişmekte olan ülkerde ortaya konulmuştur. Dolayısıyle karbondioksit emisyonu uzun dönem denge seviyelerine, finans ve ticaret sektörü kanallarınca yaklaşmaktadır. Fakat bu yakınsama, ülkelerarası farklı seviyelerdedir. Bazı ülkelerde, finansal gelişmenin emisyon hacmi üzerinde azaltıcı yönde etkisi olduğu tespit edilmiştir. İmpals etki analizleri, finans ve ticaret sektörlerinin gelişmiş olan ülkelerde karbondioksit emisyonları üzerinde negatif (azaltıcı) etkisi olduğu gözlemlenirken; gelişmekte olan ülkelerde pozitif etkisi olduğu gözlemlenmiştir. Bu gerçeklik ise gelişmiş olan ülkelerin enerji koruma politika uygulamalarında gelişmekte olan ülkelerden daha başarılı olduğunu ispatlamıştır. Dolayısıyla otoritelerin gelişmekte olan ülkelerde, enerji koruma politika uygulamalarında, finansal ve ticaret alanlarındaki gelişmelerin emisyon alanındaki büyümesinin önlenmesi amacı ile daha etkili olmaları gerekmektedir.

Anahtar Kelimeler: CO2 Emisyonu; Enerji; Gelir; Finansal Gelişme; Uluslararası Ticaret.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

The theoretical and empirical relationship between financial development and economic growth is one of the popular investigated studies in literature. There are many studies in the literature that investigate the relationship between financial development and economic growth as the case of cross-country and country-specified studies. (Jenkins and Katircioglu, 2010). Although existence of several theories that attempts to determine factors that affect economic growth, determinants of economic growth can be examined within two segments. Neoclassical growth model based on Solow's growth model emphasizes investment and according to indigenous growth model theory of Romer and Lucas, it emphasizes human capital and innovation capacity.

Financial development has been defined as an expansion in financial services and financial activities in the economy. Numerous measures have been offered in the relevant literature in order to proxy for financial development (Levine, 1998). Among them are money supply, domestic credits, volume of stocks traded in the markets (market capitalization), total assets in the economy, and liquid liabilities. Therefore, an improvement and expansion any one of these measures is assume to proxy for financial development in the economy (Levine, 1998; Beck, 2002; Jenkins and Katircioglu, 2010). Causality relationship between financial development and economic growth nexus was explored by Patrick (1966) within two theories: First theory that is *the supply-lending hypothesis* states that causal relationship is from financial development to economic growth. On the contrary, second hypothesis which is *the demand-following hypothesis* states that claim of causality is from economic growth to financial growth. Gurley and Shaw (1955 and 1966) and Goldsmith (1969) are early studies that investigate the relationship between financial development and economic growth on the basis of *the demand-following hypothesis*. On the other hand, the nexus studied by McKinnon (1973), and King (1993) support *the supply-leading hypothesis.*

Development of financial system will attract more investment and improve the economic activities in the related country. Therefore financial development leads to economic growth as a result of increase in an expansion in financial sector. Financial development and economic growth nexus has a bidirectional interaction (Abu-Bader and Abu-Quan, 2008). Financial development encourages economic growth, as well as economic growth encourages financial development. Hence, economic growth becomes causality of increase in employment, construction, transportation, population growth, industrialization and etc.

On the other hand, as it is proven in energy economics literature, energy consumption is a determinant of economic growth. There are too many studies in this literature that investigate the impact of energy consumption but not only economic growth and on carbon dioxide (CO_2) emissions (Halicioglu, 2009; and Ang, 2007 among many others). CO_2 emission is popular proxy for environment pollution in the literature. Furthermore, adapting Environmental Kuznets Curve (EKC) hypothesis in order to estimate the impact of energy consumption and economic growth on carbon emissions has been popular approach in the energy economic literature over two decades. The great majority of studies find the positive impact of energy consumption on real income and CO_2 emissions in many countries.

On the other hand, a development in financial sector not only contributes to real income positively but also contributes to an increase in energy demand and therefore consumption level; this is because of newly established institutions and firms via new constructions in the financial sector. Therefore, it is quite essential to expect that a development in financial sector would lead to an increase in energy consumption and therefore CO_2 emissions; this means that financial development will have indirect and positive impacts on carbon dioxide emissions through the channel of real income growth and energy consumption growth (Jalil and Feridun, 2011). It is therefore important for countries to adapt energy conservation policies in order to prevent further increases in emission levels due to developments in services sector and therefore increases in energy consumption.

Jalil and Feridun (2011) show that financial development and energy consumption, and also economic growth and energy consumption are in a bidirectional relationship, which encourages each other to boost. Even though this thesis will more concentrate on the nature of the relationship between financial development and environment quality (as proxied by carbon emission level), financial development will lead to more business, foreign direct investment, and more industrialization, which in turn will increase in pollution.

It is an important case to examine causality relationship between economic growth, energy consumption and environmental quality. Growth in employment opportunities will attract population flow as well as extra transportation and urbanization which cause energy consumption as well as pollution. Air pollution, water pollution, and land contamination are some of traditional segments of pollution. Air pollution will be tracked to investigate changes in environmental quality by measuring the changes in CO_2 emissions. On the light of increase in pollution, caused by greatly increased human activity, there is negative impact on environmental quality. Financial development and economic growth is so related with deterioration of environmental quality because of more energy consumption.

The relationship between financial development, economic growth and also environmental quality may be examined from the other aspects. Jensen (1996) suggests that financial development will attract more foreign direct investment, and in turn it will cause economic growth, industrial pollution and also change in environmental quality. Frankel and Romer (1999) state that financial development is associated with foreign direct investment, so more investment in research and development (R&D). Therefore that will end up with economic growth and changes in environmental quality. Tamazian and Rao (2010) also point out that financial development will cause more foreign direct investment and increase in R&D, which will reduce environmental pollution.

On the contrary, Jensen (1996) states that financial development will cause industrialization and that will result in industrial pollution as a destructive effect on environmental quality. The relationship between environmental pollution and economic growth is one of the arguments in literature. In one point of view, economic growth leads to increase of field of activity which cause inevitably environment destructions. On the other hand, other views claim that environmental deterioration could be solved by economic growth.

Economic growth and environmental pollution is another nexus of the research. In literature, the relationship between economic growth and environmental pollution determined by EKC hypothesis is inverted by a U-shape curve. EKC hypothesis claims that environmental pollution increases in parallel to economic growth until a peak turning point, and then it starts to decrease. Grossman and Krueger (1991) were the first on literature that investigate this nexus. It is followed by Shafik (1994), Heil and Selden (2001), Friedl and Getzner (2003), Dinda and Coondooa (2006), and Managi and Jena (2008), Wyckoff and Roop (1994), Suri and Chapman (1998), and many others.

1.1 Aim and Importance of the Study

Although there are highly considerable numbers of studies that search the links between financial development and growth, energy consumption and growth, energy consumption and carbon emissions, and finally carbon emissions and growth, there are very rare studies that search the relationship between financial development and environmental pollution (carbon emissions) through the channels of real income growth and energy consumption. The study of Jelil and Feridun (2011) is one of them. Therefore, the debate draws too much attention from researchers.

This study is very important in the sense that it is the first time in the relevant literature which investigates this relationship comparatively with regards to developing and developed economies. It is evident that the result of this thesis will provide very important massages for scholars and policy makers. Focus of this research has been separated between developed and developing economies since it is argued that developed countries show more emphasis on and are more successful in adapting energy conservation policies than developing countries (Halicioglu, 2009; and Ang, 2007).

The aim of the thesis is therefore to search the impact of financial development on environmental quality through the channels of economic growth and energy consumption in the selected developing and developed countries. This way will enable us to observe any discrepancy between developed and developing economies.

1.2 Data and Methodology in Brief

The thesis selects developing and developed countries according to their income classification by World Bank (2012), which data is based on its availability in annual figures. In order to estimate the impact of financial development on environmental quality in developing and developed countries, the latest econometric procedures will be employed via EVIEWS 7.2 software; these approaches are namely unit root tests, co-integration approaches, error correction analysis, impulse responses, and variance decompositions.

1.3 Structure of the Study

The study is preceded as follows: section 2 reviews the literature, section 3 describes the theoretical settings, section 4 describes methodology, and section 5 includes empirical results and discussion. Finally section 6 includes the conclusion and policy implications.

Chapter 2

LITERATURE REVIEW

2.1 Financial Development and Growth

This chapter will cover an overview of studies the related nexus in the literature. As mentioned in the previous chapter, the interrelation between financial development and economic growth nexus has been a widely examined case since the begining of the century. There are several different views that have been argued. For instance, McKinnon (1973), Goldsmith (1969), and Shumpeter (1911) defend that financial development is a critical determinant of growth. Besides, King and Levine (1993) defend that financial development has a serious effect on economic growth and Levine and Zervos (1998) argue that the banking sector development and stock market has a positive relation on economic development. The hypothesis of financial development leads to economic growth supported by using cross-sectional data of economic growth by Levine and Zervos (1998), Rajan and Zingales (1998), King and Levine (1993), Gelb (1989), and so on. On the other hand, time series data was used to support econometric hypothesis by Shan et al. (2001), Arestis and Demetriades (1997), Demetriades and Hussein (1996), Demetriades and Luintel (1996), Gupta (1984), Sims (1972) and so on. On the contrary, Stern (1989) , Lucas (1988), and Robinson (1952) defend another view that financial development has litte effect on economic growth.

Also Shan et al. (2001) and Shan (2012) found little support about their study that states finance leads to economic development. There are contradictions about nexus in literature. Jung (1986) applied Grenger's (1969) causality test for cross-sectional data for 56 countries and found positive relationship between financial development and economic growth. Hovewer, Thornton (1996) also applied Grenger's (1969) causality test for 22 developing countries and could not find an evidence about positive relationship. Schuempeter (1911) claimed that financial development is a necessary and determinant impact on economic growth, while Robinson (1952) conversely claimed that financial development is not a determinant impact on economic growth. Financial instutitions, services, and products are proliferate as fiancial development to cover extra demand as a result of economic growth. Shan et al. (2001) found an evidence of interaction between variables which have bidirectional interaction.

2.2 Economic Growth and Environmental Quality

Aforementioned relationship between economic growth and environmental quality is described by Environmental Kuznet Curve which is a U-shape relation that states economic growth has a deteriorative effect on environmental quality until a certain level, which is a turning point, and then it leads to improvement in environment. Managia and Jena (2008), Dinda and Coondooa (2006 and 2008), Nohman and Antrobus (2005), Stern (2004), Copeland and Taylor (2004), Frield and Getzner (2003),Dasgupta et al. (2003), Heil and Selden (1999), Suri and Chapman (1998), Shafik (1994), Wyckoff and Roop (1994), Selden and Song (1994), and Grossman and Krueger (1991) have all examined this matter. Somewhat, conflict occurs according to empirical results of those studies. Using different kinds of pollutant or panel data of heterogeneous countries in test leads to various turning points in U-shape relation of economic growth and environmental quality nexus and therefore lead to miscellaneous turning point results. Other strand in positive dual relationship between economic growth and energy consumption is studied in literature by income and energy consumption by Wolde-Rufael (2009), Lee and Chang (2008), Sari and Soytas (2007), Al-Iriani (2006), Lee (2005), and etc. However there is no consensus on the matter mentioned above, accordingly Karanfil (2009) claimed that there are also myriad other factors that are important in demand of energy consumption such as financial development. This case has also been studied in literature by a more narrowed perspective. For instance, Han and Wei (2004) from China found that there is causality between GDP and energy consumption whereas Yuan et al. (2008) investigated that GDP as economic growth is a forceful determinant of energy consumption. Chang (2010) studied the Granger causality relationship between economic growth, energy consumption and CO2 emissions and concludes by close relationship between variables. On the contrast, the belief of bidirectional interaction between variables, causality test of economic growth, energy consumption and CO2 emissions for the case of China, Zhang and Cheng (2009) found out empirical results as neither CO2 emissions nor energy consumption lead to economic growth.

Additional to the study of economic growth and its inevitable effect on environmental quality nexus, financial development to the model by Frankel and Romer (1999) along with consciousness of financial development can attract more foreign direct investment, so it can result in quicker economic growth and better environmental performance.

Another importance of financial development may also be the using of environmental friendly products and technologies which will definitely result in economic welfare.

Tamazian et al. (2009) observed that improvement on financial development and economic growth has reducing effect on environmental deterioration by more foreign direct investment, and research and development. Most recently, Tamazian and Rao (2010) took institutional quality with financial development into consideration and emphasize the importance destructive effect of financial liberation on environmental quality unless there is a failure of good institutional framework. The study of causality relationship between economic growth, environmental quality, and financial development was also investigated by Grossman and Krueger (1991), and Claessens and Feijen (2007). On the other hand, there are contrary views in literature; for instance, Jensen (1996) pointed out that because financial development encourages industrial pollution, it has negative effects on environmental quality. What is more, the empirical results of Kolstad and Krautkraemer (1993) support the same hypothesis as the more energy resources are used the more economic activity occurs but leads to environmental deterioration in the long run.

2.3 Economic Growth and Energy Consumption

Another strand of this study is related with economic growth and energy consumption nexus. The interrelationship is also a dual interaction, thus as the energy consumption increases the economic development is encouraged and likewise economic growth encourages an increase in the energy consumption. Kraft and Kraft (1978) examined that relationship and found out that causality originates from gross national product and results in energy consumption. This nexus was also followed by Masih and Masih (1996), Wolde-Rufael (2006), Narayan and Singh (2007), and Narayan and Singh (2007), and Halicioglu (2009) examined the bidirectional causality relationship between CO_2 emissions and commercial energy consumption and also between CO_2 emissions and income in the case of Turkey. In literature, there are lots of opponent views such as Shafik and Goldemberg argued that CO_2 emissions is increasing parallel to the increase in per capita GDP. However, Goldemberg (1998) claimed that environmental deterioration confronts with technological production process which has been controlled in developed countries. Also Panayotou (1997) claimed that environmental deterioration can be reduced by qualified policies and institutions even though it has low income level.

2.4 Financial Sector Development and Environment Quality

To the best of our knowledge it is only Jalil and Feridun (2011) till the date which used a data range between 1953 and 2006 to investigate the impact of financial development, economic growth and energy consumption on environmental pollution in China. Autoregressive Distributed Lag (ARDL) bound test used to examine the relationship between financial development and environmental pollution in the long run as the aim of study. However, test results suggested that financial development did not have any impact on environmental pollution. On the other hand income, energy consumption, and trade have a long-term impact on CO_2 emissions, which was proved by use of Environmental Kuznets Curve.

Chapter 3

THEORETICAL SETTING

The research of enviromental quality is a largely investigated study in literature. Economic growth, energy consumption and financial development are widely used determinants of enviromental quality. Enviromental quality is a set of characteristics of air, water, and noise pollution. This study investigates changes in enviromental quality in terms of air pollution. Even though carbon dioxide, sulfur dioxide, particular matter (PM_{10}, $PM_{2.5}$ and PM_1), ozone and volatile organic compounds, toxic organic micro-pollutants (TOMPS), benzene, 1,3-butadiene, carbon monoxide, lead and heavy metals are causes of air pollition, some studies use sulfur dioxide and carbon dioxide as air pollution causes. Moreover some of the studies consider just carbon dioxide as for that cause. This study will concentrates on only carbondioxide level as indicator of air quality, so environmental quality Halicioglu (2009) among many others. Change in enviromental quality is related to economic growth, energy consumption and financial development. Financial development index (FD) will be used as a financial development indicator; trade (TRD) will be used as an indicator of aggregate trade volume; gross domestic product (GDP) will be used as a economic growth indicator and energy use (ENERGY) will be used as energy consumption. Therefore the following function will be used to observe functional relationship of this study in parallel to the work of Jalil and Feridun (2011):

$CO2_t$ = f (GDP_t,FD_t, TRD_t, $ENERGY_t$) (1)

Where CO2 stands for carbondioxide emissions by countries at period t, GDP is gross domestic product at period t, FD is financial development at period t, TRD is trade at period t, and, ENERGY is energy consumption at period t. To capture the growth impact functional relationship will be expressed in a logarithmic form as long run equation by assuming that all variables are stationary (Katircioglu 2010). So the following equation will be a long run regression equation:

$$\ln CO2_t = \beta_0 + \beta_1 lnGDP_{t+}\beta_2 lnFD_{t+}\beta_3 lnTRD_{t+}\beta_4 lnENERGY_t + \varepsilon_t \quad (2)$$

Where ln CO2 is a natural logarithm of carbon dioxide emissions; ln GDP is a natural logarithm of gross domestic product, ln FD is a natural logarithmic form financial development index, ln TRD is a natural logarithmic form of trade and finally ln ENERGY is a natural logarithmic form of energy consumption. It is the long run growth regression equation where β_0 is intercept, β_1 is the elasticity coefficient of GDP, β_2 is the elasticity coefficient of FD, β_3 is the elasticity coefficient of TRD, β_4 is the elasticity coefficient of ENERGY, and ε_t is error correction term of the long run equation.

Also the following the equation will be used to estimate an error correction model to capture the speed of adjustment between short run and long run levels of CO2 emissions. Equation (2) can be also thought of trade and finance induced EKC model since these variables are added to the classical EKC modeling that searches relationship between energy consumption, growth, and CO2 emissions. In energy economics literature, EKC hypothesis has been tested extensively using a model where CO emissions are dependent variable while income, squared income, and energy consumption are independent variables. Squared income was added to the model in the literature due to the fact that CO2 emissions remains fixed beyond some period as income continues to increase. However, in this study, squared income variable has been omitted since our estimations have suffered from degrees of freedom owing to the number of observations.

$$\Delta \ln CO2_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta \ln CO2_{t-j} + \sum_{i=0}^{n} \beta_2 \quad \Delta lnGDP_{t-j} + \sum_{i=0}^{n} \beta_3 \Delta lnFD_{t-j} + \sum_{i=0}^{n} \beta_4 \Delta lnTRD_{t-j} + \sum_{i=0}^{n} \beta_5 \Delta lnENERGY_{t+}\beta_6 \varepsilon_{t-1} + u_t \quad (3)$$

Where ε_{t-1} is used as one period lagged error correction term (ECT) that is estimated from functional relationship in logarithmic form which is the second equation for the short run equation. Error correction term will show how fast disequilibrium will be eliminated between the short-run and the long-run values of CO2 emissions. Therefore, error correction term will be expected to be statistically significant and negative (Katircioglu, 2010). And Δ represents a change in CO2, GDP, FD, TRD and ENERGY.

Equation (1) will be used to detect co-integration. In the following step, level coefficients will be detected in equation (2). And finally error correction model will be estimated by equation (3) in order to determine long-term path of dependent variables and short term coefficients. Aforementioned equations will be used for both time series and panel data analyses of the study.

Chapter 4

DATA AND EMPRICAL METHODOLOGY

This study will examine the impact of economic growth, energy, and financial sector development on the environmental quality with evidence of the developed and developing countries. Overall impact will be investigated in two sections. Time series data and panel data will be create and functional relationship will be investigated that is mentioned in previous chapter.

4.1 Data

Annual data was obtained from World Data Bank Development Indicators for the time range from 1960 to 2011. The variables that will be used in this study are gross domestic product (GDP), money and quasi money (M2), domestic credit provided by banking sector (DC), Domestic credit to private sector (DCP), trade (TRADE), energy use (ENERGY) and CO2 emissions (CO2) and finally financial development index as follows:

GDP (constant 2000 US$): Gross domestic product which is measured at constant US dollar prices.

Money and quasi money (M2) as % of GDP: Broad money as ratio of GDP

Domestic credit provided by banking sector (% of GDP): Domestic credit provided by the banking sector as ratio to GDP.

Domestic credit to private sector (% of GDP): Domestic credit provided to private sector as ratio to GDP.

Trade (% of GDP): Trade as the sum of exports and imports of goods and services as ratio to GDP.

Energy use (kt of oil equivalent): Energy consumption is kt of oil equivalent.

CO2 emissions (kt): Carbon dioxide emissions as a proxy for environment quality.

Financial Development Index (FD): Financial development index is generated from money and quasi money, domestic credit provided by banking sector and domestic credit to private sector by using variance decomposition approach of factor analysis of SPSS statistical software (Chen, 2010).

As mentioned before, this study will investigate the relationship between nexus on the evidence of developing and developed countries. Therefore data obtained seperately for developing countries is listed in Table 1 and for developed countries that is listed in Table 2. The list of developing countries was acquired from International Monetary Fund's World Economic Outlook Report of April 2011. Although there are some countries that are considered newly industrialized countries such as Brazil, People's Republic of China, India, Malaysia, Mexico, Philippines, South Africa, Thailand, and Turkey by the year 2011, they are still regarded as developing countries. On the other hand, developed countries are considered as advanced economies by IMF. For time series data analysis, E-views software will be established seperately for each country to employ tests. On the other hand, for panel data analysis, two different E-views will be created seperately for developing and developed countries by combination of their own data.

4.2 Emprical Methodology of Time Series Data

Annual data that is generated from World Data Bank (2012) will be use to employed several anlyses. At the first step, variables will be checked whether they are stationary or not. Then cointegration vector will be examined on select countries according to the result of unit root test, and finally cointegration vectors will be determined and evetually error correction models will be estimated for the short-term and long-term coefficients.

4.2.1 Time Series Unit Root Tests

Unit root test has to be done to determine variables whether they are stationary or not. This is so important because as long as variables are not stationary, logarithmic form of functional relatoinship will not be strong. Even though there are many unit root tests such as Augemented Dickey-Fuller (ADF) and Phillips and Perron (PP) which are avaliable, this thesis will use the most conservative approach which is Phillips and Perron test. Phillips and Perron test will be employed to test the stationary nature of GDP, FD, TRD, ENERGY and CO2 for level and first difference forms. Hypothesis of unit root test is as follows:

H0: unit root (non-stationary)

H1: no unit root (stationary)

4.2.2 Bound Tests of Time Series Analysis

In the following step, long run relationship has to be examined to investigate whether variables interact each other in the long run or not. Although Pesaran et al. (2001), Johansen and Juselius (1990), Johansen (1988), Engel and Granger (1969) are some of important cointegration tests, ARDL (the autoregressive distributed lag) testing approach will be adoped in this thesis to investigate cointegration vector of bound test. The hypothesis of cointegration vector is as follows:

H0: no cointegration

H1: cointegration

4.2.3 Level Estimations and Error Correction Model of Time Series Analyses

Level estimation will be employed and error correction model will be determined by using equation (3), which is emphesized in the previous chapter, to investigate speed of adjustment between short run and long run levels of CO_2 emissions, and determine the long-term path of dependent variables and short-term coefficients.

4.3 Emprical Methodology of Panel Data

Annual data series from 1960 to 2011 which is generated from World Data Bank will be used to employed several anlyses. At the first step, variables will be checked whether they are stationary or not. According to the unit root test result, analyses will be carried on to examine the cointegration vector. Eventually error correction models will be estimated for the short term and long-term coefficients.

4.3.1 Panel Unit Root Tests

Unit root test has to be done to determine variables whether they are stationary or not. Therefore several econometric approaches will be employed as detect unit roots. In order to the result of the tests, those econometric approaches such as Im Pessarand and Shin W-statistics test , Phillips and Perron test, Breintung T-statistics test, Levin Lin and Chu test, and ADF Fisher Chi-Square test will be determined whether they are stationary or not taking the order of importance in to consideration.

4.3.2 Panel Cointegration Tests of Panel Data Analyses

Then the thesis will continue with the cointegration test for the non-stationary series. It will continue by investigating whether long-term relationship between variables exists or not by using contemporary approaches of cointegration test. Those cointegration tests are Pedroni (Engel-Granger based), Kao (Engel-Granger based) and Fisher (Johansen combined).

4.3.3 Error Correction Model of Panel Data Analyses

After cointegration detection, error correction model will be determined to investigate long-term coefficients, short term coefficients and error correction term to investigate how fast this disequilibrium will be eliminated between the long run and the short run coefficients of CO_2 emissions by using equation (3).

4.3.4 Panel Impulse Response and Variance Decomposition Analyses

In the next and final step, impulse responses will be estimated in order to investigate how CO_2 emissions react to the exogenous shocks in financial and trade sectors. Afterwards, variance decomposition for CO_2 will be estimated; this shows how much of the forecast error variance of dependent variable are explained by the given exogenous shocks to independent variables.

Chapter 5

EMPIRICAL ANALYSIS

In this chapter, empirical analysis includes unit root tests, bound tests and error correction models that will be carried out using the ARDL methodology. In the initial step, unit root tests will be carried out in order to investigate the stationary nature of the variables taken into consideration. All of the empirical analyses will also be made under time series and panel data analyses as described in the previous chapter. In addition, error correction models will be examined to determine error correction term, short-term coefficients and long-term coefficients.

5.1 Time Series Analyses for Model Specification

5.1.1 Unit Root Tests of Time Series Analyses

Eviews 7.2 will be used to employ the Phillips Perron unit root test to determine all the developing and the developed countries which has non-stationary CO2 emissions variables (Pesaran et al., 2001). This unit root test has to determine the variables whether they are stationary or not. Data range from 1960 to 2011 will be used to confirm the existence of the unit root test. The Phillips Perron test will be employed as a more conservative approach than ADF. Table 11 illustrates results of the unit root test results for developing countries and Table 12 will illustrates results of the unit root test for developed countries in the appendix section.

As it is shown in Table 11, series of the most of the developing countries are integrated in different orders. Besides this, there are some variables which do not provide either any result from the unit root test because of lack of data of the related variables. As mentioned in previous chapters, CO_2 emission is a dependent variable of the model proposal in this thesis. According to the results of the Phillips Perron unit root test, the developing countries determined to be used in this study are Antigua and Barbuda, Bangladesh, Belarus, Botswana, Bulgaria, Burkina Faso, People's Republic of China, Colombia, Costa Rica, Cote d'Ivore, Djibouti, Dominica, Eritrea, Georgia, Ghana, Grenada, Guinea, Guinea-Bissau, Guyana, Haiti, Iran, Jamaica, Kiribati, Kuwait, Kyrgyzstan, Latvia, Libya, Lithuania, Macedonia, Mauritania, Moldova, Niger, Nigeria, Oman, Palau, Papua New Guinea, Philippines, Qatar, Russia, Saudi Arabia, Senegal, Sierra Leone, Solomon Islands, Suriname, Tajikistan, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Ukraine, the United Arab Emirates (UEA), Vanuatu, Venezuela, Vietnam, Yemen, Zambia, and Zimbabwe. Although Belarus, Eritrea, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Russia, Tajikistan and Ukraine have stationary CO_2 emissions level, few data statistics are available after 1992. Therefore, these countries will be eliminated from the study. Additionally Antigua and Barbuda, Botswana, Bulgaria, Burkina Faso, Costa Rica, Cote d'Ivore, Djibouti, Dominica, Georgia, Grenada, Guinea, Guinea-Bissau, Guyana, Haiti, Iran, Jamaica, Kiribati, Kuwait, Libya, Mauritania, Niger, Palau, Papua New Guinea, Philippines, Qatar, Sierra Leone, Solomon Islands, Suriname, Tonga, United Arab Emirates (UEA), Vanuatu, Vietnam, Yemen, and Zimbabwe be will also eliminated from the model due to lack of necessary data from other variables, especially the energy consumption statistics of the countries.

As it is shown in Table 12, most of the countries are integrated in different orders. In addition, there are some variables which do not give any results from the unit root test because of insufficient data. The same strategy will be employed for developed countries. As $CO2$ emissions is the dependent variable of models, Australia, Austria, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Italy, Japan, the Netherlands, Portugal, Slovakia, Spain, Switzerland, and the United States (US) has to be among the countries to be carried out in the model. Since Czech Republic, Estonia, and Slovakia have CO2 emissions statistics from 1992 and Germany has CO2 emissions statistics from 1991, these countries will be eliminated from the study. Additionally Hong Kong, Ireland, Slovakia, and Switzerland have lack of necessary data statistics of variables, especially in terms of energy consumption, these countries have already been eliminated from the study, too.

5.1.2 Bound Tests for Level Relationships of Time Series Analyses

According to the result of unit root tests, it is obvious that the variables are not integrated in the same order. Therefore ARDL modelling approach of bound test has to be employed instead of normal cointegration tests (including Johansen Approach) for the selected countries. Bangladesh, China, Colombia, Cote d'Ivore, Ghana, Nigeria, Oman, Saudi Arabia, Senegal, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Venezuela and Zambia are the developing countries which have non-stationary CO2 emissions and which fulfil the data requirement to carry on with the bound test. Australia, Austria, Canada, Cyprus, Denmark, Finland, France, Greece, Iceland, Italy, Japan, the Netherlands, Portugal, Spain and the United States are the developed countries that have non-stationary CO2 emissions and which fulfil data requirement to carry on with the bound test. First of all, bound test will be applied to all selected countries. Then unrestricted intercept and no trend critical value tables of Narayan (2005) for F-statistics will determine critical values for ARDL Modelling of each country according to optimal observation numbers. Finally F III, F IV, and F V values will be investigated according to critical values of ARDL modelling approach to determine which countries will be rejected from the bound test results in order to carry on with the error correction model. Bound test results of developing countries will be illustrated from Table 15 to Table 30, and bound test results of developed countries will be illustrated from Table 31 to Table 45. As it was mentioned before, critical values for ARDL modelling approach for each country study of Narayan (2005) on F-statistics as well as the study of Pesaran, et al. (2001). Critical value tables are illustrated from Table 46 to Table 60 for developing countries and from Table 61 to Table 75 for developed countries. At the final step of bound test, F III, F IV, and F V results will be used to determine whether cointegration vector exists or not, as a proof of long-run relationship between the variables. The results of bound tests, according to the F_{CO2} (lnCO2/ lnGDP, lnENERGY, lnTRD, lnFD) model are illustrated in the appendix section Table 77 for developing countries and Table 78 for developed countries.

Bangladesh, Cote d'Ivore, and Thailand are developing countries that have become inconclusive due to the result of the bound tests which are stuck between upper and lower levels at 10 % critical values. Therefore, these countries will not be carried out for the rest of study. According to the results of bound tests, China, Colombia, Ghana, Nigeria, Oman, Saudi Arabia, Senegal, Togo, Trinidad and Tobago, Tunisia, Turkey, Venezuela and Zambia are the developing countries which rejected the null hypothesis since it is greater than 10 % critical value and this proves the long run relationship between the variables to carry on with the study.

Australia, Finland, and France are developed countries which have F-value from bound tests lower than 10 % critical value; this is resulted in accepting the null hypothesis of no level relationship. Since cointegration vector will not exist for the above mentioned countries. Australia, Finland, and France will be eliminated from the study. On the other hand, Portugal has become inconclusive by having bound test results that stuck between upper and lower levels at 10 % critical values. Therefore, Portugal countries will not be carried out for the rest of study. Austria, Canada, Cyprus, Denmark, Greece, Iceland, Italy, Japan, the Netherlands, Spain, and the United States are developed countries that reject the null hypothesis due to the results of bound tests which are greater than 10 % critical value and thus prove the long-run relationship between the variables to carry on the study.

To summarize, developing countries of whose models have been found a long-term model are China, Colombia, Ghana, Nigeria, Oman, Saudi Arabia, Senegal, Togo, Trinidad and Tobago, Tunisia, Turkey, Venezuela, and Zambia. On the other hand, developed countries of whose models have been found a long-term model are Austria, Canada, Cyprus, Denmark, Greece, Iceland, Italy, Japan, the Netherlands, Spain, and the US.

5.1.3 Level Estimations of Time Series Analyses

As mentioned above, bound test results have determined which developing and developed countries will be employed for the rest of the study. Therefore, China, Colombia, Ghana, Nigeria, Oman, Saudi Arabia, Senegal, Togo, Trinidad and Tobago, Tunisia, Turkey, Venezuela, and Zambia are countries of which level estimations will be employed as developing countries. In the meantime, Austria, Canada, Cyprus, Denmark, Greece, Iceland, Italy, Japan, the Netherlands, Spain, and the US are countries of which level estimations will be employed as developed countries.

Energy consumption is the only variable that is statistically significant in the model for the case of China. Energy consumption has positive effects on CO2 emissions level in the long run. It shows that if energy consumption rises by 1 %, CO2 emissions will ascent by 0.988038 % as it is shown in Table 79 in the appendix section.

Energy consumption, financial development, and trade are variables that are statistically significant in the model for the case of Colombia. Energy consumption, financial development and trade have positive effects on CO2 emissions level in the long run. It shows that if energy consumption rises by 1 %, CO2 emissions will ascent by 0.967829 %. If financial development rises by 1%, CO2 emissions will ascent by 0.687494 %. If trade rises 1 %, CO2 emissions will ascent by 0.373390 % as it is shown in Table 80 in the appendix section.

Energy consumption and gross domestic product are variables that are statistically significant in the model for the case of Ghana. Energy consumption and gross domestic product has positive effects on CO2 emissions level in the long run. It shows that, if gross domestic product rises by 1 %, CO2 emissions will ascent by 0.758691 %. If energy consumption rises by 1 %, CO2 emissions will ascent by 1.658982 % as it is shown in Table 81 in the appendix section.

Energy consumption, financial development, and trade are variables that statistically significant in the model for the case of Nigeria. Energy has positive effects on CO2 emissions level in the long run. Trade and financial development has negative effects on CO2 emissions level in the long run. It shows that if energy consumption rises by 1 %, CO2 emissions will ascent by 10.68611 %. If trade rises by 1 %, CO2 emissions will lessen by 1.955263 %. And also if gross domestic product rises by 1 %, CO2 emissions will lessen by 0.954691 % as it is shown in Table 82 in the appendix section.

For case of Oman, none of the variables have become statistically significant. Therefore, it does not making the case to comment on interaction between energy consumption, financial development, trade, and gross domestic product on CO2 emissions level as it is shown in Table 83 in the appendix section.

Energy consumption is the only variable that is statistically significant in the model for the case of Saudi Arabia. Energy consumption has positive effects on CO2 emissions level in the long run. It shows that if energy consumption rises by 1 %, CO2 emissions will ascent by 0.610328% as it is shown in Table 84 in the appendix section.

Energy consumption, financial development, and gross domestic product are variables that statistically significant in the model for the case of Senegal. Energy consumption has positives effects on CO_2 emissions level in the long run, however gross domestic product and financial development have negative on it. It shows that, if gross domestic product rises by 1 %, CO_2 emissions will lessen by 2.658661 %. If financial development rises by 1 %, CO_2 emissions will lessen by 0.222547 %. If energy consumption rises by 1 %, CO_2 emissions will ascent by 2.903580 % as it is shown in Table 85 in the appendix section.

Energy consumption, financial development, and gross domestic product are variables that statistically significant in the model for the case of Togo. Energy consumption and financial development has positive effect on CO_2 emissions level in long run, however gross domestic product has negative effects on it. It shows that, if gross domestic product rises by 1 %, CO_2 emissions will lessen by 1.712095 %. If financial development rises by 1 %, CO_2 emissions will ascent by 1.411894%. If energy consumption rises by 1 %, CO_2 emissions will ascent by 6.383996 % as it is shown in Table 86 in the appendix section.

Financial development and trade are variables that statistically significant in the model for the case of Trinidad and Tobago. Financial development and trade have negative effects on CO_2 emissions level in the long run. It shows that if financial development rises by 1 %, CO_2 emissions will lessen by 0.508181 %. If trade rises by 1 %, CO_2 emissions will lessen by 0.715988 % as it is shown in Table 87 in the appendix section.

Energy consumption, financial development, and trade product are variables that statistically significant in the model for the case of Tunisia. Energy consumption, financial development and trade have positive effects on CO_2 emissions level in the long run. It shows that if energy consumption rises by 1 %, CO_2 emissions will ascent by 1.339682 %. And if financial development rises by 1 %, CO_2 emissions will ascent by 0.361538 %. Finally if trade rises by 1 %, CO_2 emissions will ascent by 0.254264 % as it is shown in Table 88 in the appendix section.

Energy consumption, trade and gross domestic product are variables that statistically significant in the model for the case of Turkey. Energy consumption has negative effects on CO_2 emissions level in the long run. It shows that if energy consumption will rises by 1 %, CO_2 emissions will lessen by 0.987171%. Trade has positive effects on CO_2 emissions level in the long run. It shows that if trade rises by 1 %, CO_2 emissions will ascent by 0.434284%. Gross domestic product has positive effects on CO_2 emissions level in the long run. It shows that if energy rises by 1 %, CO_2 emissions will lessen by 3.572236 % as it is shown in Table 89 in the appendix section.

Financial development is the only variable that is statistically significant in the model for the case of Venezuela. Financial development has positive effects on CO_2 emissions level in the long run. It shows that if financial development increases by 1 %, CO_2 emissions will grow up by 0.080863 % as it is shown in Table 90 in the appendix section.

Energy consumption, financial development, and trade product are variables that statistically significant in the model for the case of Zambia. Energy consumption, financial development and trade have positive effects on CO_2 emissions level in the long run. It shows that if energy consumption rises by 1 %, CO_2 emissions will ascent by 1.233722 %. And if financial development rises by 1 %, CO_2 emissions will ascent by 0.134894 %. If trade rises by 1 %, CO_2 emissions will ascent by 1.056715 % as it is shown in Table 91 in the appendix section.

Energy consumption is the only variable that is statistically significant in the model for the case of Austria. Energy consumption has positive effects on CO_2 emissions level in the long run. It shows that if energy consumption rises by 1 %, CO_2 emissions will ascent by 1.164156 % as it is shown in Table 92 in the appendix section.

For the case of Canada, none of the variables have become statistically significant. Therefore there is no sense to command on interaction between energy consumption, financial development, trade, and gross domestic product on CO_2 emissions level as it is shown in Table 93 in the appendix section.

Financial development and trade product are variables that are statistically significant in the model for case of Cyprus. Financial development has positive effects on CO_2 emissions level in the long run; however trade has negative effects on it. It shows that if trade rises by 1 %, CO_2 emissions will lessen by 0.520190 %. And if financial development rises by 1 %, CO_2 emissions will ascent by 0.423118 % as it is shown in Table 94 in the appendix section.

Financial development and energy consumption product are variables that are statistically significant in the model for the case of Denmark. Financial development has negative effects on CO_2 emissions level in the long run; however energy consumption has positive effects on it. It shows that if energy consumption rises by 1 %, CO_2 emissions will ascent by 0.683805 %. And if financial development rises by 1 %, CO_2 emissions will lessen by 0.1784148 % as it is shown in Table 95 in the appendix section.

Energy consumption, financial development, trade, and gross domestic product are variables that are statistically significant in the model for the case of Greece. Energy consumption, financial development, and trade has positive effects on CO_2 emissions level in long run, but gross domestic product has negative effects on it. It shows that if energy consumption rises by 1 %, CO_2 emissions will ascent by 0.898622 %. If financial development rises by 1 %, CO_2 emissions will ascent by 0.108682 %. If trade rises by 1 %, CO_2 emissions will ascent by 0.099090 %. If gross domestic product rises by 1 %, CO_2 emissions will lessen by 0.476570 % as it is shown in Table 96 in the appendix section.

For case of Iceland, none of the variables have become statistically significant. Therefore, it does not making the case to comment on interaction between energy consumption, financial development, trade, and gross domestic product on CO_2 emissions level as it is shown in Table 97 in the appendix section.

Energy consumption, financial development, and gross domestic product are variables that are statistically significant in the model for the case of Italy. Since energy consumption, financial development, and gross domestic product has positive effects on CO_2 emissions level in the long run. It shows that if energy consumption rises by 1 %, CO_2 emissions will ascent by 0.746455 %. If financial development rises by 1 %, CO_2

emissions will ascent by 0.127819 %. If gross domestic product rises by 1 %, CO_2 emissions will ascent by 0.692498 % as it is shown in Table 98 in the appendix section.

Energy consumption, trade and gross domestic product are variables that are statistically significant in the model for the case of Japan. Energy consumption, and trade has positive effects on CO_2 emissions level in the long run, but gross domestic product has negative effects on it. It shows that if energy consumption rises by 1 %, CO_2 emissions will ascent by 1.615557 %. And if trade rises by 1 %, CO_2 emissions will ascent by 0.186749 %. If gross domestic product rises by 1 %, CO_2 emissions will lessen by 0.568740 % as it is shown in Table 99 in the appendix section.

Energy consumption, trade and gross domestic product are variables that are statistically significant in the model for case of Netherlands. Energy consumption has positive effects on CO_2 emissions level in long run, however gross domestic and trade product has negative effects on it. It shows that if energy consumption rises by 1 %, CO_2 emissions will ascent by 2.224018 %. And if trade rises by 1 %, CO_2 emissions will lessen by 0.501676 %. If gross domestic product rises by 1 %, CO_2 emissions will lessen by 3.736336 % as it is shown in Table 100 in the appendix section.

Trade and gross domestic product are variables that are statistically significant in the model for the case of Spain. Trade and gross domestic product has positive effects on CO_2 emissions level in the long run. It shows that if trade rises by 1 %, CO_2 emissions will ascent by 0.311192 %. And if gross domestic product rises by 1 %, CO_2 emissions will ascent by 2.003177 % as it is shown in Table 101 in the appendix section.

Energy consumption, trade and gross domestic product are variables that are statistically significant in the model for the case of US. Energy consumption has positive effects on CO_2 emissions level in the long run, but trade and gross domestic product have negative effects on it. It shows that if trade rises by 1 %, CO_2 emissions will lessen by 0.027996 %. And if gross domestic product rises by 1 %, CO_2 emissions will lessen by 0.971223%. Last of all, if energy consumption rises by 1 %, CO_2 emissions will ascent by 1.006061 % as it is shown in Table 102 in the appendix section. Table 109 at appendix section illustrates overall level equation summaries.

5.1.4 Conditional Error Correction Models of Time Series Analysis

As mentioned above, bound test results have determined which developing and developed countries will be employed for the rest of the study. Therefore, China, Colombia, Ghana, Nigeria, Oman, Saudi Arabia, Senegal, Togo, Trinidad and Tobago, Tunisia, Turkey, Venezuela, and Zambia are countries of which error correction model will be determined as developing countries. In the meantime, Austria, Canada, Cyprus, Denmark, Greece, Iceland, Italy, Japan, the Netherlands, Spain, and the US are countries of which error correction model will also be determined as developed countries.

In the case of China, as error correction term shows that there is 61.83 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. While gross domestic product is statistically significant at 5 % critical value, energy consumption becomes statistically significant at 1 % critical value. In short run, gross domestic product and financial development have positive effects on CO_2 consumption but trade and energy consumption has negative effects. If gross domestic product rises by 1 %, CO2 emissions of China will ascent by 0.377284 %. If energy consumption rises by 1 %, CO2 emissions of China will ascent by 0.890031 %. And if energy consumption rises by 1 %, CO2 emissions of China will grow up by 0.507156 % in one year, as shown in Table 104 in the appendix section.

In the case of Colombia, as error correction term shows that there is 97.50 % speed of adjustment, CO2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. While gross domestic product and energy consumption are statistically significant at 5 % critical value. Although, financial development becomes statistically significant at 1 %, trade is not statistically significant. In the short run, gross domestic product, financial development and energy consumption have positive effects on CO2 consumption. If gross domestic product increases by 1 %, CO2 emissions of Colombia will grow up by 0.572979 %. If gross domestic product increases by 1 %, CO2 emissions of Colombia will grow up by 0.878533 % in one year. If financial development increases by 1 %, CO2 emissions of Colombia will grow up by 0.362112 %. If energy consumption increases by 1 %, CO2 emissions of Colombia will grow up by 0.532233 %. If energy consumption increases by 1 %, CO2 emissions of Colombia will drop by 0.985902 % in one year, as shown in Table 104 in the appendix section.

In the case of Ghana, as error correction term shows that there is 21.76 % speed of adjustment, CO2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. While financial development and energy consumption are statistically significant at 1 % critical value, trade, and gross domestic product are not statistically significant. In the short run, energy consumption has positive effects on CO2 emissions but financial development has negative impacts on it. If financial development increases by 1 %, CO2 emissions of Ghana will diminish by 0.341155 %. If energy consumption increases by 1 %, CO2 emissions of Ghana will grow up by 0.984116 %. If energy consumption increases by 1 %, CO2 emissions of Ghana will grow up by 1.028641 % in one year, as shown in Table 104 in the appendix section.

In the case of Nigeria, as error correction term shows that there is 82.50 % speed of adjustment level CO2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Although energy consumption, trade, and financial development become statistically significant at 1 % critical value, gross domestic product becomes statistically significant at 5 % critical value. In the short run, financial development, trade and energy consumption have positive effects on CO2 emissions but gross domestic product has negative impact on CO2 emissions in general. If gross domestic product increases by 1 %, CO2 emissions of Nigeria will diminish by 1.319012 % in one year. If gross domestic product increases by 1 %, CO2 emissions of Nigeria will grow up by 1.643630 % in four years. If trade increases by 1 %, CO2 emissions of Nigeria will grow up by 1.611237 % in one year. If trade increases by 1 %, CO2 emissions of Nigeria will grow up by 0.455505 % in two years. If trade rises by 1 %, CO2 emissions of Nigeria will lessen by 0.198967 % in three years. If financial development rises by 1 %, CO2 emissions of Nigeria will ascent by 0.921166 % in one year. If financial development rises by 1 %, CO2 emissions of

Nigeria will ascent by 0.840552 % in two years. If financial development rises by 1 %, CO_2 emissions of Nigeria will ascent by 0.636080 % in three years. If financial development rises by 1 %, CO_2 emissions of Nigeria will ascent by 0.638966 % in four years. If energy consumption goes up by 1 %, CO_2 emissions of Nigeria will soar by 7.570578 %. If energy consumption goes up by 1 %, CO_2 emissions of Nigeria will soar by 1.841814 % in one year. If energy consumption goes up by 1 %, CO_2 emissions of Nigeria will soar by 3.293266 % in three years. If energy consumption goes up by 1 %, CO_2 emissions of Nigeria will soar by 1.880858 % in four years, as shown Table 104 in the appendix section.

In the case of Oman, as error correction term shows that there is 18.48 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Gross domestic product is statistically significant at 10 % critical value. On the other hand trade, financial development and energy consumption become statistically significant at 1 % critical value. In the short run, gross domestic product and financial development have positive effects on CO_2 emissions but energy consumption and trade have negative impacts on it. If gross domestic product increases by 1 %, CO_2 emissions of Oman will grow up by 0.414542 %. If gross domestic product rises by 1 %, CO_2 emissions of Oman will rise by 2.825146 % in one year. If gross domestic product increases by 1 %, CO_2 emissions of Oman will grow up by 2.710847 % in two years. If gross domestic product increases by 1 %, CO_2 emissions of Oman will grow up by 1.322180 % in three years. If trade rises by 1 %, CO_2 emissions of Oman will lessen by 0.953995 %. If trade rises by 1 %, CO_2 emissions of Oman will ascent by 1.406911 % in one year. If trade increases by 1

%, CO_2 emissions of Oman will grow up by 1.424246 % in two years. If trade increases by 1 %, CO_2 emissions of Oman will grow up by 0.615096 % in three years. If financial development rises by 1 %, CO_2 emissions of Oman will ascent by 0.471660 %. If financial development rises by 1 %, CO_2 emissions of Oman will lessen by 0.281340 % in one year. If financial development rises by 1 %, CO_2 emissions of Oman will ascent by 0.320512 % in two years. If financial development rises by 1 %, CO_2 emissions of Oman will grow up by 0.085633 % in three years. If energy consumption goes up by 1 %, CO_2 emissions of Oman will drop off by 0.221968 %. If energy consumption goes up by 1 %, CO_2 emissions of Oman will drop off by 0.196974 % in one year. If energy consumption goes up by 1 %, CO_2 emissions of Oman will soar by 0.120323 % in two years. If energy consumption goes up by 1 %, CO_2 emissions of Oman will soar by 0.083844 % in three years, as shown in Table 104 in the appendix section.

In the case of Saudi Arabia, as error correction term shows that there is 73.69 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. While gross domestic product is statistically significant at 1 % critical value, energy consumption becomes statistically significant at 5 % critical value. In the short run, gross domestic product and energy consumption have positive effects on CO_2 emissions. If gross domestic product increases by 1 %, CO_2 emissions of Saudi Arabia will rise by 0.612887 %. If energy consumption rises by 1 %, CO_2 emissions of Saudi Arabia will lessen by 0.407218 %, as shown in Table 104 in the appendix section.

In the case of Senegal, as error correction term shows that there is 77.22 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Trade and financial development become statistically significant at 1 % critical value. In the short run, trade and also financial development have positive effects on CO_2 emissions. If trade increases by 1 %, CO_2 emissions of Senegal will rise by 0.508214 % in one year. If financial development increases by 1 %, CO_2 emissions of Senegal will rise by 0.593754 % in one year, as shown in Table 104 in the appendix section.

In the case of Togo, as error correction term shows that there is 383.75 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Although financial development is statistically significant at 10 % critical value, and gross domestic product is statistically significant at 5 % critical value, trade and energy consumption become statistically significant at 1 % critical value. In the short run, gross domestic product has positive effects on CO_2 consumption but energy consumption, financial development and trade has negative impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of Togo will lessen by 0.993852 %. If gross domestic product rises by 1 %, CO_2 emissions of Togo will ascent by 3.247567 % in one year. If gross domestic product rises by 1 %, CO_2 emissions of Togo will ascent by 3.189199 % in two years. If gross domestic product rises by 1 %, CO_2 emissions of Togo will grow up by 0.683661 % in three years. If trade rises by 1 %, CO_2 emissions of Togo will lessen by 1.727708 %. If trade rises by 1 %, CO_2 emissions of Togo will lessen by 0.663084 % one year. If trade rises by 1 %, CO_2 emissions of Togo will lessen by 0.898755 % in two years. If trade rises by 1 %, CO_2 emissions of Togo will lessen by 0.557929 % in three years. If financial development rises by 1 %, CO_2 emissions of Togo will ascent by 0.385569 %. If financial development rises by 1 %, CO_2 emissions of Togo will lessen by 4.154393 % in one year. If financial development rises by 1 %, CO_2 emissions of Togo will lessen by 2.649377 % in two years. If financial development rises by 1 %, CO_2 emissions of Togo will lessen by 1.586829 % in three years. If financial development rises by 1 %, CO_2 emissions of Togo will lessen by 0.730222 % in four years. If energy consumption goes up by 1 %, CO_2 emissions of Togo will soar by 2.981704 %. If energy consumption goes up by 1 %, CO_2 emissions of Togo will drop off by 14.68272 % in one year. If energy consumption goes up by 1 %, CO_2 emissions of Togo will drop off by 10.82475 % in two years. If energy consumption goes up by 1 %, CO_2 emissions of Togo will soar by 6.347461 % in three years, as shown in Table 104 in the appendix section.

In the case of Trinidad and Tobago, as error correction term shows that there is 98.57 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Trade is statistically significant at 1 % critical value, financial development is statistically significant at 5% critical value. In the short run, trade and financial development has positive effect on CO_2 consumption but energy consumption. If trade increases by 1 %, CO_2 emissions of Trinidad and Tobago will drop by 0.594690 %. If financial development rises by 1 %, CO_2 emissions of Trinidad and Tobago will ascent by 0.222349 %. If financial development rises by 1 %, CO_2 emissions of Trinidad and Tobago will ascent by 0.426797 % in one year, as shown in Table 104 in appendix section.

In the case of Tunisia, as error correction term shows that there is 18.48 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Gross domestic product, financial development and trade are statistically significant at 5 % critical value. On the other hand energy consumption becomes statistically significant at 10 % critical value. In the short run, gross domestic product and financial development have positive effects on CO_2 emissions but energy consumption and trade has negative impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of Tunisia will ascent by 1.517535 %. If gross domestic product rises by 1 %, CO_2 emissions of Tunisia will grow up by 3.026183 % in one year. If gross domestic product rises by 1 %, CO_2 emissions of Tunisia will grow up by 2.729179 % in two years. If gross domestic product rises by 1 %, CO_2 emissions of Tunisia will grow up by 0.782159 % in four years. If trade rises by 1 %, CO_2 emissions of Tunisia will grow up by 0.511015 %. If trade rises by 1 %, CO_2 emissions of Tunisia will diminish by 0.951041 % in one year. If trade rises by 1 %, CO_2 emissions of Tunisia will lessen by 0.454519 % in two years. If trade rises by 1 %, CO_2 emissions of Tunisia will lessen by 0.334568 % in three years. If financial development rises by 1 %, CO_2 emissions of Tunisia will rise by 0.737312 %. If financial development rises by 1 %, CO_2 emissions of Tunisia will drop by 0.785306% in one year. If financial development increases by 1 %, CO_2 emissions of Tunisia will drop by 0.43281 % in three years. If energy consumption goes up by 1 %, CO_2 emissions of Tunisia will soar by 0.579208 %. If energy consumption goes up by 1 %, CO_2 emissions of Tunisia will drop off by 6.176278 % in one year. If energy consumption goes up by 1 %, CO_2 emissions of Tunisia will drop off by 5.430237 % in two years. If energy consumption goes by 1 %, CO_2 emissions of Tunisia will drop off by 3.001296 % in three years. If energy consumption goes by 1 %, CO_2 emissions of Tunisia will drop off by 1.004964 % in three years, as shown in Table 104 in the appendix section.

In the case of Turkey, as error correction term shows that there is 61.35 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Gross domestic product, trade, financial development, and energy consumption become statistically significant at 1 % critical value. In the short run, gross domestic product and also trade have positive effects on CO_2 emissions but energy consumption and financial development has negative impact on it. If gross domestic product rises by 1 %, CO_2 emissions of Turkey will grow up by 0.588507 %. If gross domestic product rises by 1 %, CO_2 emissions of Turkey will diminish by 1.237189 % in one year. If gross domestic product rises by 1 %, CO_2 emissions of Turkey will lessen by 0.899689 % in two years. If gross domestic product rises by 1 %, CO_2 emissions of Turkey will lessen by 0.305605 % in three years. If trade rises by 1 %, CO_2 emissions of Turkey will lessen by 0.133523% in one year. If trade increases by 1 %, CO_2 emissions of Turkey will grow up by 0.044780 % in five years. If financial development rises by 1 %, CO_2 emissions of Turkey will drop by 0.101622 %. If financial development rises by 1 %, CO_2 emissions of Turkey will drop by 0.170353% in one year. If financial development rises by 1 %, CO_2 emissions of Turkey will drop by 0.087704 % in two years. If financial development rises by 1 %, CO_2 emissions of Turkey will drop by 0.203193 % in three years. If financial development rises by 1 %, CO_2 emissions of Turkey will diminish by 0.105081 % in five years. If energy consumption goes up by 1 %, CO_2 emissions of Turkey will soar by 0.2630003 %. If energy consumption goes up by 1 %, CO_2 emissions of Turkey will soar by 0.529412 % in three years, as shown in Table 104 in the appendix section.

In the case of Venezuela, as error correction term shows that there is 81.39 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Gross domestic product is statistically significant at 1 % critical value. In the short run, gross domestic product has negative effects on CO_2 emissions. If gross domestic product increases by 1 %, CO_2 emissions of Venezuela will drop by 0.864644 %, as shown in Table 104 in the appendix section.

In the case of Zambia, as error correction term shows that there is 89.38 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Energy consumption is statistically significant at 1 % critical value. However gross domestic product becomes statistically at 5 % critical value, trade becomes statistically significant at 10 % critical value. In the short run, gross domestic product and energy consumption have positive effects on CO_2 emissions but trade has negative impact. If gross domestic product increases by 1 %, CO_2 emissions of Zambia will grow up by 0.846501 % in one year. If gross domestic product increases by 1 %, CO_2 emissions of Zambia will grow up by 0.651125 % in two years. If trade rises by 1 %, CO_2 emissions of Zambia will lessen by 0.253230 % in one year. If energy consumption rises by 1 %, CO_2 emissions of Zambia will ascent by 1.330299 %, as shown in Table 104 in the appendix section.

In the case of Austria, as error correction term shows that 87.69 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy emissions. Gross domestic product and trade have become statistically significant at 5 % critical value. On the other hand energy consumption becomes statistically significant at 1 % critical value. In the short run, gross domestic product, energy consumption and financial development has positive effects on CO_2 emissions but trade has negative impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of Austria will grow up by 0.692656 %. If gross domestic product rises by 1 %, CO_2 emissions of Austria will grow up by 0.625560 % in two years. If gross domestic product rises by 1 %, CO_2 emissions of Austria will grow up by 0.637216 % in four years. If gross domestic product rises by 1 %, CO_2 emissions of Austria will ascent by 1.148946 % in five years. If trade rises by 1 %, CO_2 emissions of Austria will lessen by 0.283397 %. If energy consumption rises by 1 %, CO_2 emissions of Austria will ascent by 1.189862 %, as shown in Table 105 in the appendix section.

In the case of Canada, as error correction term shows that there is 34.85 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Gross domestic product, trade, financial development, and energy consumption become statistically significant at 1 % critical value. In the short run, gross domestic product and financial development have positive effects on CO_2 emissions but energy consumption has positive impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of Canada will lessen by 0.903837 %. If gross domestic product rises by 1 %, CO_2 emissions of Canada will lessen by 2.992842 % in one year. If gross domestic product rises by 1 %, CO_2 emissions of

Canada will lessen by 1.840985 % in two years. If gross domestic product rises by 1 %, CO_2 emissions of Canada will lessen by 0.707652 % in four years. If gross domestic product rises by 1 %, CO_2 emissions of Canada will lessen by 0.753395 % in five years. If trade rises by 1 %, CO_2 emissions of Canada will lessen by 0.291886 % in one year. If trade rises by 1 %, CO_2 emissions of Canada will lessen by 0.334160 % in two years. If trade rises by 1 %, CO_2 emissions of Canada will lessen by 0.515921 % in three years. If financial development rises by 1 %, CO_2 emissions of Canada will drop by 0.050211 % in one year. If financial development rises by 1 %, CO_2 emissions of Canada will drop by 0.194750 % in two years. If financial development rises by 1 %, CO_2 emissions of Canada will drop by 0.150630 % in three years. If energy consumption goes up by 1 %, CO_2 emissions of Canada will soar by 1.287026 %. If energy consumption goes up by 1 %, CO_2 emissions of Canada will soar by 2.212149 % in one year. If energy consumption goes by 1 %, CO_2 emissions of Canada will soar by 1.048731 % in two years. If energy consumption goes up by 1 %, CO_2 emissions of Canada will soar by 1.095693 % in four years. If energy consumption goes by 1 %, CO_2 emissions of Canada will soar by 0.563420 % in five years, as shown in Table 105 in the appendix section.

In the case of Cyprus, as error correction term shows that there is 69.36 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Energy consumption becomes statistically significant at 1 % critical value. By the way, trade becomes statistically significant at 10 % critical value. In the short run, trade has negative effects on CO_2 emissions but energy consumption has positive impacts on it. If trade increases by 1 %,

CO_2 emissions of Cyprus will diminish by 0.144867 %. If energy consumption increases by 1 %, CO_2 emissions of Cyprus will rise by 0.590796 %, as shown in Table 10 in the appendix section.

In the case of Denmark, as error correction term shows that there is 95.97 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. While gross domestic product and financial development become statistically significant at 5 % critical value, energy consumption becomes statistically significant at 1 % critical value. In the short run, gross domestic product and financial development have negative effects on CO_2 emissions but energy consumption has positive impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of Denmark will lessen by 0.583063 %. If gross domestic product rises by 1 %, CO_2 emissions of Denmark will lessen by 0.601939 % in one year. If financial development rises by 1 %, CO_2 emissions of Denmark will lessen by 0.117735 %. If energy consumption goes up by 1 %, CO_2 emissions of Denmark will soar by 1.457879 %. If energy consumption goes up by 1 %, CO_2 emissions of Denmark will soar by 0.204757 % in one year, as shown in Table 105 in the appendix section.

In the case of Greece, as error correction term shows that there is 96.16 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. While gross domestic product and trace statistically significant at 5 % critical value, financial development and energy consumption become statistically at 1 % critical value. In the short run, gross domestic product, financial development, energy consumption and trade have positive effects on

CO_2 emissions. If gross domestic product increases by 1 %, CO_2 emissions of Greece will diminish by 0.373278 % in two years. If gross domestic product increases by 1 %, CO_2 emissions of Greece will diminish by 0.452510 % in three years. If trade increases by 1 %, CO_2 emissions of Greece will grow up by 0.147329 %. If financial development increases by 1 %, CO_2 emissions of Greece will grow up by 0.152365 %. If energy consumption increases by 1 %, CO_2 emissions of Greece will grow up by 0.465553 %. If energy consumption increases by 1 %, CO_2 emissions of Greece will diminish by 0.287943 % in one year, as shown in Table 105 in the appendix section.

In the case of Iceland, as error correction term shows that there is 36.53 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Gross domestic product, trade, and financial development, energy consumption are statistically significant at 1 % critical value. In the short run, gross domestic product, financial development, and energy consumption have positive effects on CO_2 emissions but trade has negative impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of Iceland will grow up by 1.880328 %. If gross domestic product rises by 1 %, CO_2 emissions of Iceland will diminish by 0.648365 % in one year. If gross domestic product rises by 1 %, CO_2 emissions of Iceland will grow up by 2.365173 % in two years. If gross domestic product rises by 1 %, CO_2 emissions of Iceland will grow up by 2.120448 % in four years. If trade rises by 1 %, CO_2 emissions of Iceland will lessen by 0.184901 %. If trade rises by 1 %, CO_2 emissions of Iceland will lessen by 0.722413 % in two year. If trade rises by 1 %, CO_2 emissions of Iceland will lessen by 0.276495 % in three years. If trade rises by 1 %, CO_2 emissions of Iceland will lessen by 0.832725 % in four years.

If trade rises by 1 %, CO_2 emissions of Iceland will lessen by 0.374460 % in five years. If financial development rises by 1 %, CO_2 emissions of Iceland will drop by 0.298269 %. If financial development rises by 1 %, CO_2 emissions of Iceland will rise by 0.097444% in one year. If financial development rises by 1 %, CO_2 emissions of Iceland will rise by 0.629857 % in three years. If financial development rises by 1 %, CO_2 emissions of Iceland will rise by 0.431562 % in four years. If financial development rises by 1 %, CO_2 emissions of Iceland will rise by 0.724161 % in five years. If energy consumption goes up by 1 %, CO_2 emissions of Iceland will drop off by 0.958753 % in one year. If energy consumption goes up by 1 %, CO_2 emissions of Iceland will soar by 0.615783 % in two years. If energy consumption goes up by 1 %, CO_2 emissions of Iceland will soar by 0.451091 % in four years, as shown in Table 105 in the appendix section.

In the case of Italy, as error correction term shows that 63.70 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. While gross domestic product becomes statistically at 5 % critical value, energy consumption becomes stationary at 1 %. In the short run, gross domestic product has negative effects on CO_2 emissions but energy consumption has positive impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of Italy will lessen by 0.318130 % in one year. If energy consumption rises by 1 %, CO_2 emissions of Italy will ascent by 0.622919 %, as shown in Table 105 in the appendix section.

In the case of Japan, as error correction term shows that there is 70.05 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Gross domestic product is statistically significant at 5 % critical value. In the meantime, trade, financial development and energy consumption become statistically at 1 % critical value. In the short run, gross domestic product and financial development have positive effects on CO_2 emissions but energy consumption and trade have negative impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of Japan will rise by 0.234282 % in two years. If gross domestic product rises by 1 %, CO_2 emissions of Japan will grow up by 0.268417 % in three years. If gross domestic product rises by 1 %, CO_2 emissions of Japan will grow up by 0.534215 % in five years. If trade rises by 1 %, CO_2 emissions of Japan will lessen by 0.134044 % in one year. If trade rises by 1 %, CO_2 emissions of Japan will lessen by 0.148092 % in two years. If trade rises by 1 %, CO_2 emissions of Japan will lessen by 0.112034 % in three years. If trade rises by 1 %, CO_2 emissions of Japan will lessen by 0.094342 % in five years. If financial development rises by 1 %, CO_2 emissions of Japan will drop by 0.311925 % in one year. If financial development rises by 1 %, CO_2 emissions of Japan will rise by 0.151809 % in two years. If energy consumption goes up by 1 %, CO_2 emissions of Japan will soar by 1.241601 %. If energy consumption goes by 1 %, CO_2 emissions of Japan will drop off by 0.238038 % in one year. If energy consumption goes up by 1 %, CO_2 emissions of Japan will drop off by 0.166988 % in two years. If energy consumption goes up by 1 %, CO_2 emissions of Japan will drop off by 0.179095 % in three years. If energy consumption goes up by 1 %, CO_2 emissions of Japan will soar by 0.118743 % in five years, as shown in Table 105 in the appendix section.

In the case of Netherlands, as error correction term shows that there is 95.09 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Gross domestic product, trade, and financial development, energy consumption become statistically at 1 % critical value. In the short run, gross domestic product, trade and also financial development have positive effects on CO_2 emissions but energy consumption has negative impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of Netherlands will rise by 1.730377 % in one year. If gross domestic product rises by 1 %, CO_2 emissions of Netherlands will grow up by 2.512887 % in two years. If gross domestic product rises by 1 %, CO_2 emissions of Netherlands will grow up by 1.990221 % in three years. If trade increases by 1 %, CO_2 emissions of Netherlands will grow up by 0.290581 %. If trade increases by 1 %, CO_2 emissions of Netherlands will grow up by 0.331496 % in one year. If trade increases by 1 %, CO_2 emissions of Netherlands will grow up by 0.197291 % in four years. If trade increases by 1 %, CO_2 emissions of Netherlands will grow up by 0.222498 % in five years. If financial development rises by 1 %, CO_2 emissions of Netherlands will rise by 0.137144 %. If financial development rises by 1 %, CO_2 emissions of Netherlands will rise by 0.171575 % in one year. If financial development rises by 1 %, CO_2 emissions of Netherlands will rise by 0.662836 % in two years. If financial development rises by 1 %, CO_2 emissions of Netherlands will rise by 0.521963 % in three years. If financial development rises by 1 %, CO_2 emissions of Netherlands will rise by 0.221415 % in four years. If financial development rises by 1 %, CO_2 emissions of Netherlands will rise by 0.396698 % in five years. If energy consumption goes up by 1 %, CO_2 emissions of Netherlands will soar by 1.130578 %. If energy consumption goes up by 1 %, CO_2 emissions of Netherlands will drop off by

0.796153 % in one year. If energy consumption goes up by 1 %, CO_2 emissions of Netherlands will drop off by 0.696381 % in two years. If energy consumption goes up by 1 %, CO_2 emissions of Netherlands will soar by 0.384806 % in three years. If energy consumption goes up by 1 %, CO_2 emissions of Netherlands will soar by 0.296625 % in five years, as shown in Table 105 in the appendix section.

In the case of Spain, as error correction term shows that there is 70.42 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. Gross domestic product is statistically significant at 5% critical value. On the other hand, trade, and financial development, and energy consumption become statistically at 1 % critical value. In the short run, financial development has positive effects on CO_2 emissions but energy consumption, gross domestic product and trade have negative impacts on it. If gross domestic product increases by 1 %, CO_2 emissions of Spain will diminish by 0.721146 % in one year. If gross domestic product increases by 1 %, CO_2 emissions of Spain will diminish by 1.500798 % in two years. If trade increases by 1 %, CO_2 emissions of Spain will grow up by 0.156782 %. If trade increases by 1 %, CO_2 emissions of Spain will grow up by 0.214894% in two years. If trade increases by 1 %, CO_2 emissions of Spain will diminish by 0.241397 % in four years. If financial development increases by 1 %, CO_2 emissions of Spain will grow up by 0.232868 %. If energy consumption increases by 1 %, CO_2 emissions of Spain will grow up by 0.1137859 %. If energy consumption increases by 1 %, CO_2 emissions of Spain will grow up by 0.334320 % in four years. If energy consumption goes up by 1 %, CO_2 emissions of Spain will drop off by 0.305592 % in five years, as shown in Table 105 in the appendix section.

In the case of US, as error correction term shows that there is 62.96 % speed of adjustment, CO_2 emissions will converge its long-term equilibrium every year by GDP, financial development, trade and energy consumption. While gross domestic product becomes statistically significant at 10 % critical value, trade and energy consumption become statistically at 1 % critical value and finally financial development becomes statistically significant at 5 % critical value. In the short run, gross domestic product has negative effects on CO_2 emissions but energy consumption, financial development and trade have positive impacts on it. If gross domestic product rises by 1 %, CO_2 emissions of US will drop by 0.224736 % in two years. If gross domestic product rises by 1 %, CO_2 emissions of US will diminish by 0.356048 % in three years. If gross domestic product rises by 1 %, CO_2 emissions of US will grow up by 0.242614 % in four years. If trade rises by 1 %, CO_2 emissions of US will grow up by 0.116302 %. If financial development increases by 1 %, CO_2 emissions of US will grow up by 0.094068 %. If financial development increases by 1 %, CO_2 emissions of US will grow up by 0.099459 % in one year. If financial development increases by 1 %, CO_2 emissions of US will grow up by 0.299463 % in two years. If energy consumption goes up by 1 %, CO_2 emissions of US will soar by 0.841290 %. If energy consumption goes up by 1 %, CO_2 emissions of US will soar by 0.386947 % in one year. If energy consumption goes up by 1 %, CO_2 emissions of US will soar by 0.910794 % in two years. If energy consumption goes up by 1 %, CO_2 emissions of US will soar by 0.413952 % in three years, as shown in Table 105 in the appendix section.

5.2 Panel Data Analyses for Model Specification

5.2.1 Unit Root Tests of Panel Data Analyses

Eviews 7.2 will be employed for panel data analysis to determine whether it is stationary or not. According to the order of the importance, Im Pessarand and Shin W-statistics test (IPS) , Phillips and Perron test (PP), Breintung T-statistics test (B T-stat.), Levin Lin and Chu test (LLC), and ADF Fisher Chi-Square tests (ADF M-W) of econometric approaches applied for level and for first difference form for both developing and developed countries. According to the panel data for developing countries, LLC, IPS, ADF- M W, and PP tests are suggested to reject null hypothesis, unlike the results of Breingtung T-test which is in trend and intercept model. Therefore carbon dioxide emissions become non-stationary. With regard to GDP, LLC, IPS, ADF- M W, and PP test results suggest GDP is non-stationary in intercept and without trend model. For energy consumption, LLC, ADF- M W, and PP test results suggest to reject null hypothesis in trend and intercept model. On the other hand, LLC, IPS, ADF- M W, and PP test results suggest that energy consumption is non-stationary in intercept and without trend model. For financial development index, LLC, ADF- M W, and PP test results suggest that energy consumption become non-stationary, only if both trend and intercept are excluded from the model. For trade, IPS, ADF- M W and PP tests suggest that trade also becomes non-stationary as the panel data variables of developed countries. Unit root test results in level and first difference forms for developed countries are illustrated at table 1 and table 2, respectively.

Table 1. Panel Unit Root Tests at Level Form (developed countries)

	Levels				
				ADF	
Variables	LLC	Breitung t-stat	IPS	M-W	PP
Log(CO2)					
τ_T	-7.434*	6.032	-4.187*	118.240*	103.960**
τ_μ	-15.693*		-9.258*	242.460*	345.847*
τ	10.423			17.099	42.906
Log(GDP)					
τ_T	-3.783*	7.771	0.720	55.486	51.866
τ_μ	-18.083*		-7.634*	258.986*	295.920*
τ	28.410			1.370	0.305
Log(ENERGY)					
τ_T	-6.370*	8.363	-0.874	79.531***	93.631*
τ_μ	-19.663*		-12.054*	323.057*	396.483*
τ	15.411			4.621	5.464
Log(FD)					
τ_T	0.650	3.152	0.176	90.152**	67.819
τ_μ	0.385		4.835	43.009	47.364
τ	-5.317*			147.722*	169.715*

Table 1. Panel Unit Root Tests at Level Form (developed countries continued)

Variables	LLC	Levels Breitung t-stat	IPS	ADF M-W	PP
Log(TRD)					
τ_T	-3.880*	-1.134	-3.346*	95.940*	98.917*
τ_μ	-1.431***		1.091	62.477	60.262
τ	7.061			6.656	5.896

*Note: Log(CO2) indicates CO2 emissions; Log(GDP) indicates GDP; Log(ENERGY/) indicates energy consumption; Log(FD) indicates financial development index; Log(TRD) indicates trade in natural logarithm.. The model with a intercept and trend designate by τ_{T}; the model with a intercept and without trend designate by τ_μ; and finally, the model without a intercept and trend designate by τ. The null hypothesis refuse at the 1% level manifest by *. The null hypothesis refuse between 1% level and 5 % level manifest by **. The null hypothesis refuse between the 5 % level and 10 % level by ***.*

Table 2. Panel Unit Root Tests at 1st Difference (developed countries)

Variables	LLC	1st Breitung t-stat	Difference IPS	ADF M-W	PP
Log(CO2)					
τ_T	-28.228*	-14.642*	29.7461*	776.200*	1026.45*
τ_μ	-27.122*		-28.217*	743.318*	848.756*
τ	-27.264*			1045.18*	1160.82*
Log(GDP)					
τ_T	-21.782*	-13.752*	-18.670*	474.042*	486.262*
τ_μ	-18.633*		-17.441*	437.745*	461.641*
τ	-12.936*			279.285*	291.446*
Log(ENERGY)					
τ_T	-29.431*	-16.671*	-30.920*	820.117*	1064.61*
τ_μ	-26.413*		-27.961*	713.888*	720.592*
τ	-22.017*			702.829*	825.996*
Log(FD)					
τ_T	-21.468*	-10.470*	-21.131*	526.538*	714.355*
τ_μ	-22.572*		-22.767*	577.608*	535.739*
τ	-23.928*			998.471*	1024.91*

Table 2. Panel Unit Root Tests at 1st Difference (continued)

Variables	LLC	1st Difference Breitung t-stat	IPS	ADF M-W	PP
Log(TRD)					
τ_T	-34.073*	-20.202*	-29.286*	716.999*	805.218*
τ_μ	-34.789*		-30.699*	830.446*	885.350*
τ	-33.849*			1225.36*	1428.00*

Note: Log(CO2) indicates CO2 emissions; Log(GDP) indicates GDP; Log(ENERGY) indicates energy consumption; Log(FD) indicates financial development index; Log(TRD) indicates trade in natural logarithm.. The model with a intercept and trend designate by $\tau_{T;\ the}$ model with a intercept and without trend designate by τ_μ; and finally, the model without a intercept and trend designate by τ. The null hypothesis refuse at the 1% level manifest by *. The null hypothesis refuse between 1% level and 5 % level manifest by **. The null hypothesis refuse between the 5 % level and 10 % level by ***.

For GDP, LLC, IPS, ADF- M W, and PP test results suggest that GDP is a non-stationary variable by both trend and intercept model. However, GDP becomes non-stationary only if trend is excluded from model by LLC test result. Even though energy consumption becomes non-stationary which is suggested by LLC, IPS, ADF- M W, and PP test results with the most restricted model which is without both trend and intercept. Also financial development index is suggested by LLC, IPS, ADF- M W, and PP test results that it is non-stationary variable with trend and intercept model. LLC, B-T stat, IPS, ADF- M W, and PP test results suggest that trade is a non-stationary variable with both trend and intercept model at level forms for developing countries. Unit root test results at level and first difference forms for developed countries are illustrated at table 3 and table 4, respectively.

Table 3. Panel Unit Root Tests at Level Form (developing countries)

Variables	LLC	Level Breitung t-stat	IPS	ADF M-W	PP
Log(CO2)					
τ_T	-8.542*	4.472	-4.798*	540.685*	561.350*
τ_μ	-13.245*		-5.995*	506.894*	673.186*
τ	25.138			60.621	53.020
Log(GDP)					
τ_T	0.641	10.389	5.392	236.167	307.717
τ_μ	-3.187*		10.407	264.696	308.424
τ	65.915			12.320	13.574
Log(ENERGY)					
τ_T	21.436	5.0E-10	2.126	183.671	207.746
τ_μ	-234.125*		-161.413*	400.501*	487.137*
τ					

Table 3. Panel Unit Root Tests (developing countries continued)

Variables	LLC	Level Breitung t-stat	IPS	ADF M-W	PP
Log(FD)					
τ_T	-9.437*	1.734	-5.360*	648.279*	493.521*
τ_μ	-6.230*		-1.711**	393.291*	392.923*
τ	-18.811*			831.262*	821.457*
Log(TRD)					
τ_T	-7.628*	-4.128*	-7.066*	508.305*	535.773*
τ_μ	-5.489*		-6.853*	503.150*	513.288*
tτ					

*Note: Log(CO2) indicates CO2 emissions; Log(GDP) indicates GDP; Log(ENERGY) indicates energy consumption; Log(FD) indicates financial development index; Log(TRD) indicates trade in natural logarithm.. The model with a intercept and trend designate by $\tau_{T;\ the}$ model with a intercept and without trend designate by τ_μ; and finally, the model without a intercept and trend designate by τ. The null hypothesis refuse at the 1% level manifest by *. The null hypothesis refuse between 1% level and 5 % level manifest by **. The null hypothesis refuse between the 5 % level and 10 % level by ***.*

Table 4. Panel Unit Root Tests at 1st Difference (developing countries)

Variables	LLC	First Breitung t-stat	Difference IPS	ADF M-W	PP
Log(CO2)					
τ_T	-74.451*	-37.149*	-70.144*	4240.22*	6535.83*
τ_μ	-74.851*		-71.869*	4006.47*	4067.37*
τ	-70.124*			6632.70*	6968.97*
Log(GDP)					
τ_T	-42.391*	-29.510*	-40.806*	2089.94*	2163.19*
τ_μ	43.239*		-43.523*	2364.27*	2382.08*
τ	-24.026*			2139.21*	2156.70*
Log(ENERGY)					
τ_T	-34.728*	-2.8E-10	-39.111*	1690.83*	2402.26*
τ_μ	-38.573*		-39.543*	1691.74*	1746.67*
τ	-737.999*			1762.28*	1797.80*

Table 4. Panel Unit Root Tests at 1st Difference (developing countries continued)

Variables	LLC	First Breitung t-stat	Difference IPS	ADF M-W	PP
Log(FD)					
$\boldsymbol{\tau_T}$	-66.979*	-21.896*	-47.676*	2606.26*	3285.60*
$\boldsymbol{\tau_\mu}$	-67.810*		-55.762*	2725.12*	2899.18*
τ	-66.947*			4584.75*	5155.02*
Log(TRD)					
$\boldsymbol{\tau_T}$	-66.986*	-34.665*	-57.934*	3243.10*	4857.10*
$\boldsymbol{\tau_\mu}$	-70.207*		-65.811*	3590.00*	3867.84*
τ	-75.947*			7514.75*	8819.17*

Note: Log(CO2) indicates CO2 emissions; Log(GDP) indicates GDP; Log(ENERGY) indicates energy consumption; Log(FD) indicates financial development index; Log(TRD) indicates trade in natural logarithm.. The model with a intercept and trend designate by $\tau_{T;\ the}$ model with a intercept and without trend designate by τ_μ; and finally, the model without a intercept and trend designate by τ. The null hypothesis refuse at the 1% level manifest by *. The null hypothesis refuse between 1% level and 5 % level manifest by **. The null hypothesis refuse between the 5 % level and 10 % level by ***.

5.2.2 Cointegration Tests of Panel Data Analyses

In this section co integration test will be employed to investigate long run relationship between variables that is formulated in equation (1). Pedroni (Engel-Granger based), Kao (Engel-Granger based), and Fisher (combined Johansen based) tests will be applied as cointegration test. Engle – Grenged based Pedroni cointegration test is employed with three different scenarios which are with trend and intercept, with intercept, and finally without trend and finally without trend and intercept.

Table 5 illustrates cointegration test results of developed countries. Engle-Granger based Pedroni test assumes that an autoregressive coefficient which is within dimensions rejected only null hypothesis of no integration where intercept is included according to 10 % alpha level of v-statistics and PP-statistics.

Additionally Engel-Granger based Kao cointegration test Augmented Dickey- Fuller (ADF) test statistics becomes statistically significant at 5 %. Therefore Engel-Granger based Kao cointegration test also rejects the null hypothesis of no integration test.

Finally Johansen based Fisher cointegration test rejects the null hypothesis of no cointegration with 1% alpha level of trace test of Fisher statistics and also with 1 % alpha level maximum eigen test of Fisher statistics.

Therefore, all cointegration test approaches confirmed cointegration relation in functional relationship between variables. CO2 emissions have a long-run equilibrium relationship between GDP, energy consumption, financial development index, and trade in developed countries.

Table 5. Cointegration Tests (developed countries)

Panel (a). Pedroni (Engel-Granger based) Cointegration Tests

	Alternative hypothesis: common AR coefs. (within-dimension)		
Test Statistic	Trend and Intercept	Intercept	Without Trend and Intercept
Panel v-Statistic	0.112	1.500***	0.208
Panel rho-Statistic	9.584	7.683	6.362
Panel PP-Statistic	-0.779	-1.397***	-0.170
Panel ADF-Statistic	-1.115	-1.034	0.139

	Alternative hypothesis: individual AR coefs. (between-dimension)		
Test Statistic	Trend and Intercept	Intercept	Without Trend and Intercept
Group rho-Statistic	10.966	9.523	8.726
Group PP-Statistic	-11.546*	-7.846*	-6.337*
Group ADF-Statistic	-6.116*	-5.924*	-4.233*

Table 5. Cointegration Tests (developed countries continued)

Panel (b). Kao (Engel-Granger based) Cointegration Test

Null hypothesis: No Cointegration	
Test Statistic	Individual Intercept
	Rho
ADF	-1.794**

Panel (c). Fisher (combined Johansen based) Cointegration Test

Null hypothesis: No Cointegration		
Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Fisher Stat.* (from max-eigen test)
None	294.3*	232.7*
At most 1	169.2*	125.5*
At most 2	82.10*	69.70***
At most 3	43.86	36.37
At most 4	58.91	58.91

*Note: Levels in panels (a), (b), and (c) are rejected null hypothesis * and ** and***expresses at 0.01, 0.05 and 0.10, respectively*

Table 6 illustrates cointegration test results of developing countries. Engle-Granger based Pedroni test assumes that autoregressive coefficients which are within dimensions reject only the null hypothesis of no integration where intercept and trend are included according to 1 % alpha level of ADF-statistics and 5 % of alpha level of PP-statistics. Besides this, the autoregressive coefficient between dimensions reject the null hypothesis of no cointegration where trend and intercept are included according to 1 % alpha level of ADF-statistics and 1 % of alpha level of PP-statistics.

Additionally, Engel-Granger based Kao cointegration test Dickey- Fuller (DF) test statistics become statistically significant at 1%. Therefore, Engel-Granger based Kao cointegration test also rejects the null hypothesis of no integration test.

Finally, Johansen based Fisher cointegration test reject the null hypothesis of no cointegration with 1% alpha level of trace test of Fisher statistics and also with 1 % alpha level maximum eigen test of Fisher statistics.

Therefore, all cointegration test approaches confirm cointegration relation in functional relationship between variables. Carbon dioxide emission has a long-run equilibrium relationship between GDP, energy consumption, financial development index, and trade for developing countries.

Table 6. Cointegration Tests (developing countries)

Panel (a). Pedroni (Engel-Granger based) Cointegration Tests

	Alternative hypothesis: common AR coefs. (within-dimension)		
Test Statistic	Trend and Intercept	Intercept	Without Trend and Intercept
Panel v-Statistic	-4.721	-1.554	0.103
Panel rho-Statistic	14.962	13.024	10.609
Panel PP-Statistic	-2.067**	-2.104**	-3.677*
Panel ADF-Statistic	-3.611*	-2.245**	-3.833*

Table 6. Cointegration Tests (developing countries continues)

Test Statistic	Alternative hypothesis: individual AR coefs. (between-dimension)		
	Trend and Intercept	Intercept	Without Trend and Intercept
Group rho-Statistic	17.474	16.692	15.610
Group PP-Statistic	-22.882*	-14.903*	-13.175*
Group ADF-Statistic	-15.251*	-13.708*	-13.229*

Panel (b). Kao (Engel-Granger based) Cointegration Test

Null hypothesis: No Cointegration	
Test Statistic	Individual Intercept
	Rho
DF	10.651*
DF*	11.281*

Table 6. Cointegration Tests (developing countries continues)

Panel (c). Fisher (combined Johansen based) Cointegration Test

Null hypothesis: No Cointegration

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Fisher Stat.* (from max-eigen test)
None	909.3*	608.4*
At most 1	539.0*	362.3*
At most 2	276.3*	208.5*
At most 3	161.7**	140.8
At most 4	170.9**	170.9**

*Note: Levels in panels (a), (b), and (c) are rejected null hypothesis * and ** and *** expresses at 0.01, 0.05 and 0.10, respectively*

5.2.3 Error Correction Models of Panel Data Analyses

In this section long-run and short-run coefficients will be determined by level estimation that is formulated in equation (2) and also error correction term to investigate how fast disequilibrium will be eliminated between long-run and short-run coefficients of carbon dioxide emissions that is formulated in equation (3).

Both level equation and error correction term for developed countries are illustrated in Table 7 as follows:

Table 7. Level Equations and Error Correction Model of Developed Countries for Panel Data

Cointegration Model	Coefficients	t-statistics
LCO2(-1)	1.000000	
LGDP(-1)	-11.23099	-2.472**
LENERGY(-1)	13.58730	3.047*
LFD(-1)	7.800310	1.905***
LTRD(-1)	20.11270	6.036*
C	54.29768	
Error Correction Model	**$\Delta lnCO2$**	**t-statistics**
ECT_{t-1}	-0.001034	-5.128*
$\Delta lnCO2_{t-1}$	-0.181602	-4.105*
$\Delta lnCO2_{t-2}$	0.011523	0.241
$\Delta lnCO2_{t-3}$	-0.062895	-1.327
$\Delta lnCO2_{t-4}$	-0.049869	-1.054
$\Delta lnCO2_{t-5}$	-0.053981	-1.157
$\Delta lnCO2_{t-6}$	0.024246	0.532
$\Delta lnGDP_{t-1}$	0.366576	3.424*
$\Delta lnGDP_{t-2}$	0.187865	1.643
$\Delta lnGDP_{t-3}$	-0.136269	-1.198
$\Delta lnGDP_{t-4}$	0.063307	0.571
$\Delta lnGDP_{t-5}$	-0.087323	-0.806
$\Delta lnGDP_{t-6}$	0.300793	3.084*
$\Delta lnENERGY_{t-1}$	0.048857	0.848
$\Delta lnENERGY_{t-2}$	-0.039179	-0.653
$\Delta lnENERGY_{t-3}$	0.132256	2.228**

Table 7. Level Equations and Error Correction Model of Developed Countries (continued)

Error Correction Model	lnCO2	t-statistics
$\Delta lnENERGY_{\tau-5}$	0.026584	0,464
$\Delta lnENERGY_{\tau-6}$	0.084434	1,506
$\Delta lnFD_{\tau-1}$	0.014937	0,598
$\Delta lnFD_{\tau-2}$	-0,018532	-0,742
$\Delta lnFD_{\tau-3}$	-0,008109	-0,325
$\Delta lnFD_{\tau-4}$	-0,009176	-0,364
$\Delta lnFD_{\tau-6}$	0.025603	1,039
$\Delta lnFD_{\tau-1}$	-0,103005	-2.676**
$\Delta lnFD_{\tau-2}$	0.021417	0,554
$\Delta lnTRD_{\tau-3}$	-0,027941	-0,734
$\Delta lnTRD_{\tau-4}$	-0,004424	-0,118
$\Delta lnTRD_{\tau-5}$	-0,012266	-0,331
$\Delta lnTRD_{\tau-6}$	-0,02117	-0,578
C	-0,013483	-2.476**
R-squared	0.129821	0.296700
Adj. R-squared	0.100436	0.272950
F-statistic	4.417930	12.49275
Akaike AIC	-2,501679	-4,753487
Schwarz SC	-2,338093	-4,589901

Table 7. Level Equations and Error Correction Model of Developed Countries (continued)

Determinant resid covariance (dof adj.)	9.21E-14
Determinant resid covariance	7.76E-14
Log likelihood	7599.012
Akaike information criterion	-15,65055
Schwarz criterion	-14,80706

*Notes: Optimum selected lag by Schwartz Criterion is 2. * and ** and *** represents statistical significance of variables at the 0.01 and 0.05 and 0.10, respectively.*

In level equation, ENERGY, FD and TRD are statistically significant and have positive impacts on CO2 emissions in the long-run but GDP has positive impact on CO2 emission. One per cent change in GDP leads to 11.230 % decrease in CO2 emissions. One per cent change in Energy leads to 13.587 % increase in CO2 emissions. One per cent change in FD leads to 7.800 % increase in CO2 emissions. And finally one per cent change in TRD leads to 20.112 % increase in CO2 emissions.

In error correction model, error correction term is statistically significant and as it is expected it is negative but low. ECT suggests that 0.103 % of difference between long-term and short-term equilibrium is eliminated at the end of each year. Therefore disequilibrium in CO2 emissions converge equilibrium at low levels.

Finally, short-term coefficients of GDP are statistically significant at lag 1 and lag 6. Also it indicates positive short-term movements. Whenever GDP increases by one per cent, CO2 emissions increases by 0.366 % at lag 1 and CO2 emissions increases by

0.300 % at lag 6. Short-term coefficients of ENERGY are statistically significant at lag 3 and lag 4. Also it indicates positive short-term movements. Whenever ENERGY increases by one per cent, CO2 emissions increase by 0.132 % at lag 3 and CO2 emissions increase by 0.144 % at lag 4. Even though FD does not become statistically significant as a short-term coefficient, short-term coefficient of TRD is statistically significant at lag 6. But it indicates negative short-term movements. Whenever TRD increases by one per cent, CO2 emissions decreases by 0.103 % at lag 6.

Both level equation and error correction term for developing countries are illustrated in table 8 as follows:

Table 8. Level Equations and Error Correction Model of Developing Countries for Panel Data

Cointegrating Model	Coefficients	t-statistics
$lnCO2_{t-1}$	1.000000	
$lnGDP_{t-1}$	-0.760015	-8.898*
$lnENERGY_{t-1}$	-0.251521	-2.987**
$lnFD_{t-1}$	-0.453222	-5.867*
$lnTRD_{t-1}$	0.058908	0.673
C	9.739313	
Error Correction Model	**$\Delta lnCO2$**	**t-statistics**
ECT_{t-1}	-0.042971	-9.164*
$lnCO2_{t-1}$	-0.106830	-5.068*
$lnCO2_{t-2}$	-0.094056	-4.484*

Table 9. Level Equations and Error Correction Model of Developing Countries for Panel Data

Error Correction Model	$\Delta lnCO2$	t-statistics
$lnGDP_{t-1}$	0.373667	4.880*
$lnGDP_{t-2}$	0.031250	0.413
$lnENERGY_{t-1}$	0.219946	3.782*
$lnENERGY_{t-2}$	0.181041	3.218*
$lnFD_{t-1}$	0.008113	0.440
$lnFD_{t-2}$	0.021209	1.309
$lnTRD_{t-1}$	0.024042	0.893
$lnTRD_{t-2}$	-0.006057	-0.229
C	0.014860	3.105*
R-squared	0.069224	0.182515
Adj. R-squared	0.064757	0.178591
F-statistic	15.49642	46.52005
Akaike AIC	-0.775454	-3.368638
Schwarz SC	-0.745546	-3.338729
Determinant resid covariance (dof adj.)		8.52E-11
Determinant resid covariance		8.30E-11
Log likelihood		10394.19
Akaike information criterion		-8.966307
Schwarz criterion		-8.804303

*Notes: Optimum selected lag by Schwartz Criterion is 2. * and ** and *** represents statistical significance of variables at the 0.01 and 0.05 and 0.10, respectively.*

In level equation, GDP, ENERGY, and FD are statistically significant and have negative impacts on CO2 emissions in the long-term. But TRD is not statistically significant in long run. One per cent change in GDP leads to 0.760 % decrease in CO2 emissions. One per cent change in ENERGY leads to 0.251 % decrease in CO2 emissions. One per cent change in FD leads to 0.453% decrease in CO2 emissions. To sum up, all dependent variables have negative effects on CO_2 emissions in the long run that is contradicted to the main theory of the thesis. But it is a not big issue because of low Adj. R-square.

In error correction model, error correction term is statistically significant and as it is expected it is negative but low. ECT suggests that 4.297 % of difference between long-term and short-term equilibrium is eliminated at the end of each year. Therefore disequilibrium in CO_2 emissions converges equilibrium at low levels.

Finally, short-term coefficients of GDP are statistically significant at lag 1. Also it indicates positive short-term movements. Whenever GDP increases by one per cent, CO_2 emissions increases by 0.373 % at lag 1. Short term coefficients of ENERGY are statistically significant at lag 1 and lag 2. Also it indicates positive short-term movements. Whenever ENERGY increases by one per cent, CO_2 emissions increases by 0.219 % at lag 1 and CO_2 emissions increases by 0.181 % at lag 2. But none of the short-term coefficients of FD and TRD are statistically significant.

5.2.4 Panel Impulse Response and Variance Decomposition Results

This section finally will evaluate results reached from impulse response functions and variance decompositions which are estimated through vector autoregressive systems. Figure 1 gives impulse responses among variables in the case of developed countries under inspection. It is seen that reaction of CO_2 emissions to a given shock in GDP is in the same direction over time. When, for example, GDP is increased, reaction of CO_2 emissions to this increase will be positive all the time. On the other hand, reaction of CO_2 emissions to given shocks in financial development, energy and trade sectors are negative all the time. When finance, energy and trade variables are increased, reaction of emissions level will be in the negative direction (decreasing). This is consistent with the reality that developed countries adapt energy conservation policies successfully compared to the developing ones in order to reduce emissions levels.

Table 9 represents variance decompositions among the variables in the case of developed economies. It is seen that ratio of variance explained in CO2 emissions by the given changes in GDP, energy, finance, and trade are generally low. This means that variations in CO2 emissions explained by those regressors are at low levels. For example, at period 10, variance ratio of CO2 emissions due to changes in GDP is 4.15 %, in financial development is 0.89 %, in energy is 0.28 %, and in trade sector is 4.01 %.

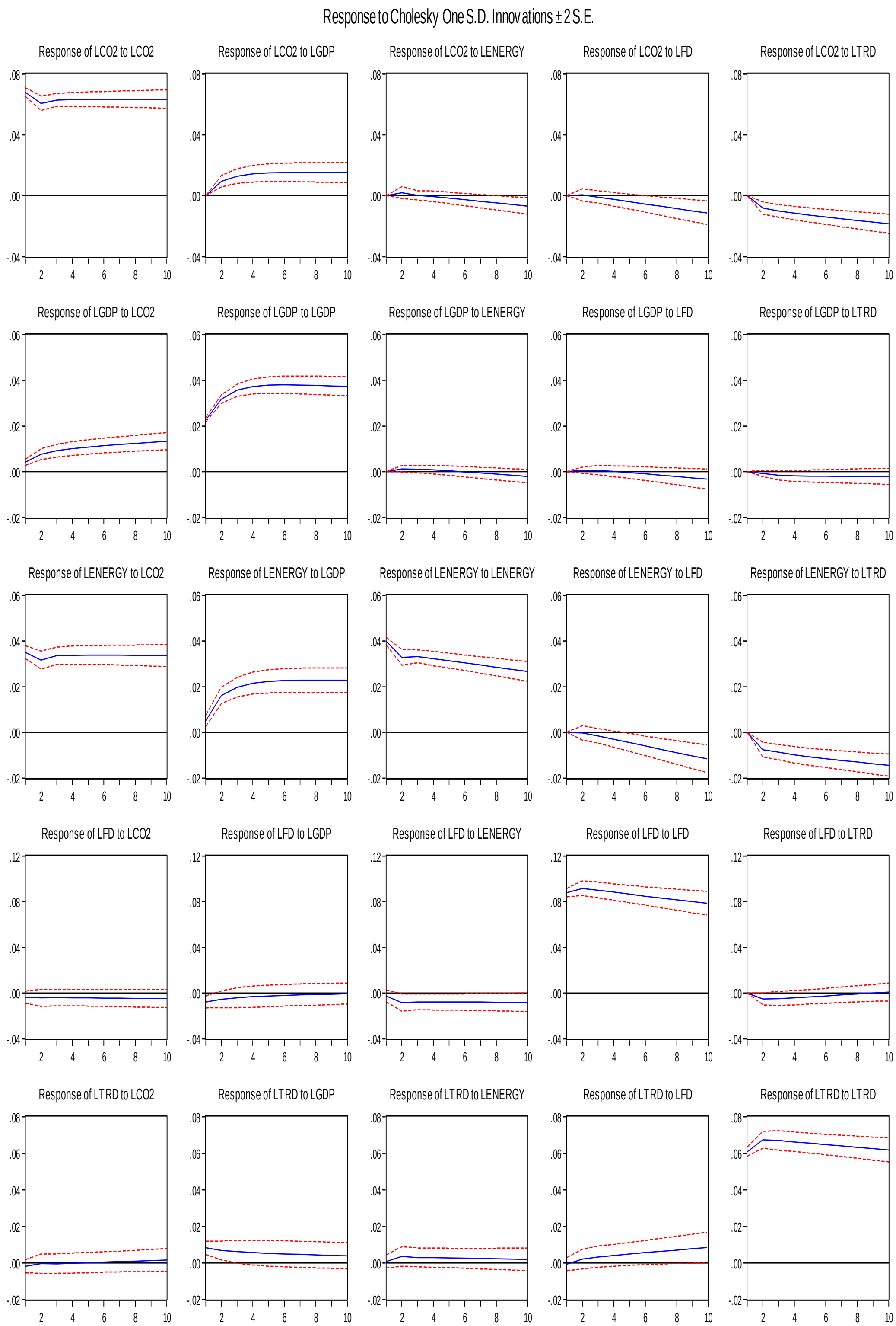

Figure 1. Impulse Response Analysis for Developed Countries

Table 10. Variance Decompositions for Developed Countries

Variance Decomposition of LCO2						
Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.067954	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.091968	98.10387	1.062232	0.049337	0.003603	0.780961
3	0.112580	96.63024	2.021285	0.033204	0.009182	1.306091
4	0.130392	95.46086	2.727979	0.025993	0.039248	1.745918
5	0.146338	94.49789	3.222753	0.031901	0.101220	2.146237
6	0.160917	93.65827	3.565523	0.052325	0.196819	2.527064
7	0.174467	92.88226	3.803717	0.088324	0.325544	2.900151
8	0.187220	92.13417	3.968940	0.139760	0.485757	3.271372
9	0.199347	91.39245	4.082076	0.206193	0.675301	3.643979
10	0.210972	90.64463	4.156988	0.286949	0.891800	4.019633

Variance Decomposition of LGDP						
Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.023127	3.228412	96.77159	0.000000	0.000000	0.000000
2	0.040008	4.708111	95.13125	0.094709	0.023801	0.042133
3	0.054390	5.359940	94.41917	0.091944	0.023376	0.105571
4	0.066722	5.852580	93.90768	0.075830	0.016076	0.147838
5	0.077487	6.276627	93.47543	0.058819	0.014278	0.174845
6	0.087067	6.672094	93.06551	0.046648	0.023398	0.192349
7	0.095738	7.055400	92.65278	0.041896	0.045616	0.204308
8	0.103702	7.434740	92.22470	0.045852	0.081615	0.213093
9	0.111102	7.814437	91.77487	0.059196	0.131368	0.220128
10	0.118045	8.196889	91.30001	0.082298	0.194513	0.226293

Variance Decomposition of LENERGY						
Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.053361	43.20452	0.900550	55.89493	0.000000	0.000000
2	0.072378	42.49994	5.458156	50.91841	0.001319	1.122172
3	0.089079	42.23013	8.500171	47.54054	0.032217	1.696939
4	0.103357	42.00543	10.65356	45.05748	0.105759	2.177764
5	0.115948	41.89472	12.16214	43.12011	0.231048	2.591977
6	0.127254	41.84620	13.25851	41.50931	0.410213	2.975767
7	0.137573	41.83159	14.08106	40.09990	0.642905	3.344552
8	0.147115	41.83072	14.71529	38.81964	0.927274	3.707074
9	0.156039	41.83097	15.21439	37.62572	1.260747	4.068177
10	0.164462	41.82439	15.61243	36.49222	1.640359	4.430597

Table 9: Variance Decompositions for Developed Countries (continues)

Variance Decomposition of LFD						
Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.088355	0.177189	0.811950	0.087789	98.92307	0.000000
2	0.127875	0.196113	0.572784	0.472509	98.59530	0.163291
3	0.156797	0.195865	0.452302	0.559746	98.58467	0.207417
4	0.180253	0.200300	0.374521	0.616441	98.59655	0.212191
5	0.200199	0.206647	0.320659	0.656132	98.61600	0.200561
6	0.217641	0.214697	0.280814	0.688879	98.63242	0.183193
7	0.233175	0.223872	0.249943	0.717766	98.64364	0.164779
8	0.247193	0.233822	0.225217	0.744370	98.64881	0.147784
9	0.259966	0.244291	0.204965	0.769503	98.64762	0.133618
10	0.271697	0.255096	0.188147	0.793632	98.63997	0.123151

Variance Decomposition of LTRD						
Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.061364	0.091303	1.794022	0.014047	0.012233	98.08840
2	0.091400	0.043821	1.355479	0.151621	0.057129	98.39195
3	0.113510	0.030301	1.169307	0.164347	0.118061	98.51798
4	0.131620	0.022735	1.050473	0.167982	0.183033	98.57578
5	0.147192	0.018216	0.965806	0.166714	0.254857	98.59441
6	0.160975	0.015793	0.900173	0.163499	0.334441	98.58609
7	0.173406	0.015099	0.846430	0.159243	0.421919	98.55731
8	0.184767	0.015952	0.800660	0.154403	0.517079	98.51191
9	0.195251	0.018238	0.760574	0.149229	0.619578	98.45238
10	0.205001	0.021875	0.724750	0.143872	0.729029	98.38047

Finally, figure 2 gives impulse responses among variables in the case of developing countries under inspection. It is seen that reaction of CO_2 emissions to a given shock in GDP, energy, financial development, and trade sectors is in the same direction all the time. When, for example, GDP, energy, finance, and trade are increased, reaction of CO_2 emissions to this increase will be positive over time. This proves the reality that expansion in the economy, energy, finance and trade sectors leads to increases in carbon emissions and thus deteriorates environment quality in the developing countries.

Table 10 presents variance decompositions among the variables in the case of developing economies. It is seen that ratio of variance explained in CO_2 emissions by the given changes in GDP, energy, finance, and trade are again low like developed countries. This means that variations in CO_2 emissions explained by those regressors are at low levels again. For example, at period 10, variance ratio of CO_2 emissions due to changes in GDP is 5.98 %, in financial development is 0.09 %, in energy is 1.03 %, and in trade sector is 0.29 %. It is seen that contribution of financial sector to variance in CO_2 emissions in the developing countries is lower than those in developed countries.

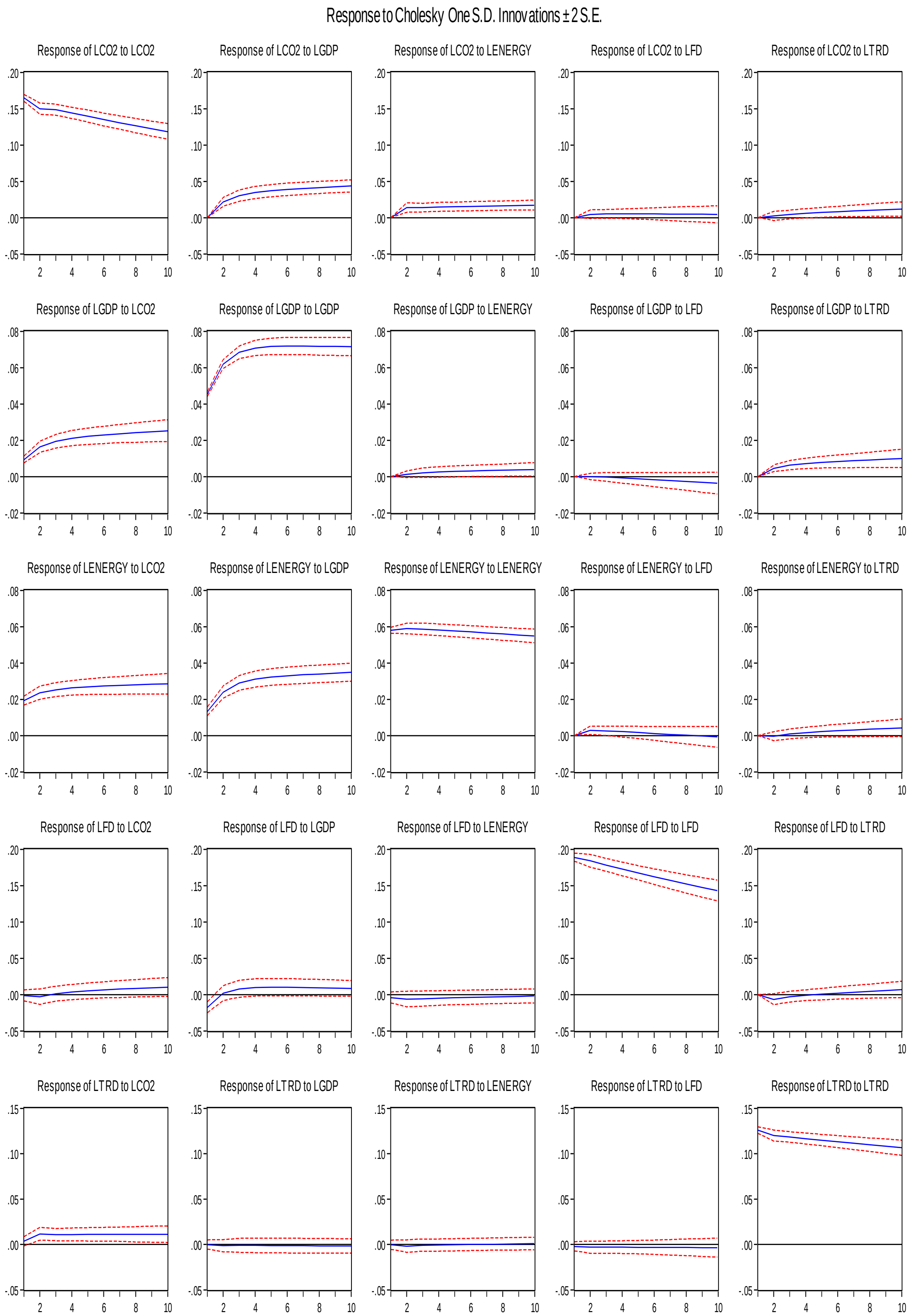

Figure 2. Impulse Response Analysis for Developing Countries

Table 11. Variance Decompositions for Developing Countries

Variance Decomposition of LCO2

Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.164807	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.224174	98.65541	0.921255	0.375123	0.039706	0.008508
3	0.270949	97.53423	1.864102	0.510112	0.061640	0.029917
4	0.309231	96.58222	2.673007	0.611130	0.074635	0.059005
5	0.341709	95.77302	3.357916	0.694126	0.083287	0.091650
6	0.369888	95.05629	3.958684	0.768536	0.089343	0.127148
7	0.394757	94.39725	4.505309	0.838311	0.093655	0.165480
8	0.416999	93.77340	5.017627	0.905524	0.096686	0.206765
9	0.437104	93.17061	5.508263	0.971310	0.098715	0.251102
10	0.455437	92.57998	5.985237	1.036322	0.099924	0.298542

Variance Decomposition of LGDP

Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.046324	4.059152	95.94085	0.000000	0.000000	0.000000
2	0.079194	5.622360	94.03183	0.026169	2.59E-05	0.319617
3	0.106629	6.435774	92.99365	0.051750	0.000844	0.517981
4	0.129957	6.972039	92.29775	0.071910	0.003818	0.654483
5	0.150289	7.384972	91.75668	0.088646	0.009640	0.760058
6	0.168414	7.733164	91.29554	0.103541	0.018462	0.849295
7	0.184876	8.043128	90.87974	0.117492	0.030197	0.929448
8	0.200048	8.328159	90.49182	0.131007	0.044665	1.004351
9	0.214192	8.595478	90.12235	0.144378	0.061661	1.076134
10	0.227496	8.849265	89.76595	0.157777	0.080974	1.146036

Variance Decomposition of LENERGY

Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.062523	9.445839	4.481957	86.07220	0.000000	0.000000
2	0.092282	10.83571	8.748276	80.31745	0.097053	0.001514
3	0.115912	11.59827	11.74391	76.53977	0.111905	0.006151
4	0.135950	12.15418	13.76120	73.95984	0.106142	0.018635
5	0.153523	12.58405	15.19388	72.09262	0.094738	0.034718
6	0.169293	12.93987	16.27728	70.64740	0.082501	0.052943
7	0.183689	13.24892	17.14468	69.46213	0.071345	0.072924
8	0.197001	13.52642	17.87270	68.44419	0.062105	0.094577
9	0.209435	13.78128	18.50694	67.53875	0.055150	0.117892
10	0.221141	14.01893	19.07552	66.71206	0.050623	0.142863

Table 10: Variance Decompositions for Developing Countries (continued)

Variance Decomposition of LFD						
Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.189778	0.004264	0.864937	0.049116	99.08168	0.000000
2	0.264526	0.014608	0.449530	0.082235	99.39120	0.062431
3	0.319129	0.010940	0.366785	0.088929	99.48136	0.051985
4	0.363059	0.016671	0.353552	0.087779	99.50096	0.041033
5	0.399963	0.028876	0.354552	0.084543	99.49805	0.033982
6	0.431761	0.045672	0.357039	0.080688	99.48542	0.031185
7	0.459627	0.066130	0.358407	0.076682	99.46624	0.032536
8	0.484345	0.089754	0.358460	0.072718	99.44115	0.037918
9	0.506473	0.116225	0.357486	0.068892	99.41015	0.047244
10	0.526424	0.145294	0.355797	0.065260	99.37321	0.060442

Variance Decomposition of LTRD						
Period	S.E.	LCO2	LGDP	LENERGY	LFD	LTRD
1	0.125818	0.075566	0.000249	0.001468	0.029724	99.89299
2	0.174205	0.485282	0.006456	0.012019	0.045148	99.45109
3	0.210846	0.592091	0.006981	0.009912	0.050664	99.34035
4	0.241152	0.660062	0.007424	0.008326	0.054858	99.26933
5	0.267310	0.707419	0.007985	0.006968	0.058613	99.21901
6	0.290458	0.744405	0.008709	0.005914	0.062159	99.17881
7	0.311288	0.775172	0.009574	0.005175	0.065593	99.14449
8	0.330254	0.801900	0.010557	0.004754	0.068959	99.11383
9	0.347676	0.825820	0.011638	0.004648	0.072281	99.08561
10	0.363792	0.847680	0.012800	0.004854	0.075570	99.05910

Chapter 6

CONCLUSION

6.1 Summary of Major Findings

This study aimed to investigate the nexus of financial development, energy consumption, and economic growth with the environmental quality for developing and developed countries. Research question of this study is that "does financial sector development not only leads to energy and economic expansion but also to an increase in carbon dioxide emissions?" Initially all of countries listed in World Bank database was selected; however, many countries have been eliminated either due to insufficient number of observations or stationary problem of series under consideration.

This thesis has employed time series plus panel data analyses to compare if results would be robust. Both approaches prove that carbon emissions in both developed and developing countries are in long-term economic and statistical relationship with its determinants which are real income, energy consumption, financial development, and trade growth. These determinants apply statistically significant impacts on carbon emissions both in the long-term and short-term periods. Financial sector affects carbon emission level through the channels of energy and economic expansion in the economic long term. Furthermore, carbon emissions converge to their long-term path significantly through its determinants mentioned above where financial sector is one of them.

It is very important to mention that similar conclusions have been obtained in bound tests and error correction models among developed and developing countries. But, results from impulse response analyses are different across developed and developing countries. In the case of developed countries, it is found that reaction of CO2 emissions to a given shock in GDP is in the same direction over time. When, for example, GDP is increased, reaction of CO2 emissions to this increase will be positive all the time. This is also the same in the case of developing countries.

Reaction of CO2 emissions to given shocks in financial development, energy and trade sectors are negative in the case of developed countries. When finance, energy and trade variables are increased, for example, reaction of carbon emissions will be in the negative direction (decreasing). However, reaction of CO2 emissions to given shocks in financial development, energy and trade sectors are positive in the case of developing countries. This finding suggests that developed countries are more successful in energy conservation policies than developing countries in order to reduce carbon emissions levels.

Finally, results from variance decompositions show that the ratio of variance explained in CO2 emissions by the given changes in GDP, energy, finance, and trade are generally low in the case of both developed and developing economies under inspection.

6.2 Policy Implications and Further Research

Major results of this thesis suggest that finance, trade, and economic growth have positive and statistically significant impacts on carbon emissions levels in developed and developing countries. Results also support the reality that developed countries are more successful than developing ones in adapting energy conservation policies. Therefore, when promoting trade and finance sectors in developing economies, authorities in those regions should effectively adapt energy conservation policies in order to prevent increases in carbon emissions levels and environmental deterioration. Results of this thesis show that expansion in finance and trade sectors of developing countries will lead to increases in carbon emissions through energy expansion. Therefore, it is essential that energy conservation policies adapted in developed countries need to be replicated by authorities in developing countries as well.

This thesis has used carbon emissions level as a proxy for environment quality as advised in the energy economics literature. This was only due to data availability. However, there are alternative proxies for environmental quality level that can be developed or proposed in order to reach alternative results. Therefore, further researches can be replicated using alternative measurements for environmental quality.

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APPENDIX

APPENDIX: LIST OF TABLES

Table 12. List of developing countries

ID	Country	ID	Country
1	Afghanistan	76	Lithuania
2	Albania	77	Macedonia
3	Algeria	78	Madagascar
4	Angola	79	Malawi
5	Antiguan and Barbuda	80	Malaysia
6	Argentina	81	Maldives
7	Armenia	82	Mali
8	Azerbaijan	83	Marshall Islands
9	Bahamas	84	Mauritania
10	Bahrain	85	Mauritius
11	Bangladesh	86	Mexico
12	Barbados	87	Federal States of Micronesia
13	Belarus	88	Moldova
14	Belize	89	Mongolia
15	Benin	90	Montenegro
16	Bhutan	91	Morocco
17	Bolivia	92	Mozambique
18	Bosnia and Herzegovina	93	Namibia
19	Botswana	94	Nepal
20	Brazil	95	Nicaragua
21	Bulgaria	96	Niger
22	Burkina Faso	97	Nigeria
23	Burundi	98	Oman
24	Cambodia	99	Pakistan
25	Cameroon	100	Palau
26	Cape Verde	101	Panama
27	Central African Republic	102	Papua New Guinea
28	Chad	103	Paraguay
29	Chile	104	Peru
30	People's Republic of China	105	Philippines

Table 11.List of developing countries (continued)

30	People's Republic of China	105	Philippines
31	Colombia	106	Poland
32	Comoros	107	Qatar
33	Democratic Republic of the Congo	108	Romania
34	Republic of the Congo	109	Russia
35	Costa Rica	110	Rwanda
36	Cote d'Ivoire	111	St.Kitts and Nevis
37	Croatia	112	St.Lucia
38	Djibouti	113	St.Vincent and the Grenadines
39	Dominica	114	Sao Tome and Principe
40	Dominican Republic	115	Saudi Arabia
41	Ecuador	116	Senegal
42	Egypt	117	Serbia
43	El Salvador	118	Seychelles
44	Equatorial Guinea	119	Sierra Leone
45	Eritrea	120	Solomon Islands
46	Ethiopia	121	Somalia
47	Fiji	122	South Africa
48	Gabon	123	South Sudan
49	The Gambia	124	Sri Lanka
50	Georgia	125	Sudan
51	Ghana	126	Suriname
52	Grenada	127	Swaziland
53	Guatemala	128	Syria
54	Guinea	129	Tajikistan
55	Guinea-Bissau	130	Tanzania
56	Guyana	131	Thailand
57	Haiti	132	Togo
58	Honduras	133	Tonga
59	Hungary	134	Trinidad and Tobago
60	India	135	Tunisia

Table 11. List of developing countries (continued)

61	Indonesia	136	Turkey
62	Iran	137	Turkmenistan
63	Iraq	138	Tuvalu
64	Jamaica	139	Uganda
65	Jordan	140	Ukraine
66	Kazakhstan	141	UAE
67	Kenya	142	Uruguay
68	Kiribati	143	Uzbekistan

Table 13. List of developed countries

ID	Country	ID	Country
1	Australia	18	Japan
2	Austria	19	Luxembourg
3	Belgium	20	Malta
4	Canada	21	Netherlands
5	Cyprus	22	New Zealand
6	Czech Republic	23	Norway
7	Denmark	24	Portugual
8	Estonia	25	San Marino
9	Finland	26	Singapore
10	France	27	Slovakia
11	Germany	28	Slovenia
12	Greece	29	Spain
13	Hong Kong	30	Sweden
14	Iceland	31	Switzerland
15	Ireland	32	UK
16	Israel	33	US
17	Italy		

Table 14. Unit root tests using PP approach for developing countries

Country	Ln GDP	ln ENERGY	ln CO2	ln FD	ln TRD
Afghanistan	-	-	I (0)	I (1)	I (0)
Albania	I (0)	I (0)	I (0)	I (1)	I (1)
Algeria	I (0)	I (1)	I (0)	I (1)	I (1)
Angola	I (0)	I (0)	I (0)	I (1)	I (1)
Antiguan and Barbuda	I (0)	I (0)	I (1)	I (1)	I (1)
Argentina	I (0)	I (0)	I (0)	I (1)	I (1)
Armenia	I (1)	I (1)	I (0)	I (1)	I (1)
Azerbaijan	I (0)	I (1)	I (0)	I (1)	I (1)
Bahamas	I (1)	-	I (0)	I (1)	I (1)
Bahrain	I (1)	I (1)	I (0)	I (1)	I (1)
Bangladesh	I (0)	I (0)	I (1)	I (1)	I (1)
Barbados	I (1)	-	I (0)	I (1)	I (1)
Belarus	I (0)	I (1)	I (1)	I (1)	I (1)
Belize	I (0)	-	I (0)	I (1)	I (1)
Benin	I (0)	-	I (0)	I (1)	I (1)
Bhutan	I (0)	-	I (0)	I (1)	I (1)
Bolivia	I (0)	I (0)	I (0)	I (1)	I (1)
Bosnia and Herzegovina	I (1)	I (0)	I (0)	I (1)	I (1)
Botswana	I (0)	I (0)	I (1)	I (1)	I (1)
Brazil	I (0)	I (1)	I (0)	I (1)	I (1)
Bulgaria	I (0)	I (0)	I (1)	I (1)	I (1)
Burkina Faso	I (0)	-	I (1)	I (1)	I (1)
Burundi	I (0)	-	I (0)	I (1)	I (1)
Cambodia	I (0)	I (0)	I (0)	I (1)	I (1)
Cameroon	I (0)	I (1)	I (0)	I (1)	I (1)
Cape Verde	I (0)	-	I (0)	I (1)	I (1)
Central African Republic	I (0)	-	I (0)	I (1)	I (1)
Chad	I (0)	-	I (0)	I (1)	I (1)
Chile	I (0)	I (0)	I (0)	I (1)	I (1)
People's Republic of China	I (1)	I (0)	I (1)	I (1)	I (1)
Colombia	I (0)	I (0)	I (1)	I (1)	I (1)
Comoros	I (1)	-	I (0)	I (1)	I (1)
Democratic Republic of the Congo	I (0)	I (0)	I (0)	I (1)	I (1)
Republic of the Congo	I (0)	I (0)	I (0)	I (1)	I (1)

Table 13. Unit root tests using PP approach for developing countries (continued)

Costa Rica	I (0)	I (0)	I (0)	I (1)	I (1)
Cote d'Ivoire	I (1)	I (0)	I (1)	I (1)	I (1)
Croatia	I (1)	I (1)	I (0)	I (1)	I (1)
Djibouti	I (0)	-	I (1)	I (1)	I (1)
Dominica	I (0)	-	I (1)	I (1)	I (1)
Dominican Republic	I (0)	I (0)	I (0)	I (1)	I (1)
Ecuador	I (0)	I (0)	I (0)	I (1)	I (1)
Egypt	I (0)	I (0)	I (0)	I (1)	I (1)
El Salvador	I (0)	I (0)	I (0)	I (1)	I (1)
Equatorial Guinea	I (0)	-	I (0)	I (1)	I (1)
Eritrea	I (1)	I (0)	I (1)	I (1)	I (0)
Ethiopia	I (0)	I (0)	I (0)	I (1)	I (1)
Fiji	I (1)	-	I (0)	I (1)	I (1)
Gabon	I (0)	I (0)	I (0)	I (1)	I (1)
The Gambia	I (0)	-	I (0)	I (1)	I (1)
Georgia	I (0)	I (1)	I (1)	I (1)	I (1)
Ghana	I (0)	I (0)	I (1)	I (1)	I (1)
Grenada	I (0)	-	I (1)	I (1)	I (1)
Guatemala	I (0)	I (0)	I (0)	I (1)	I (1)
Guinea	I (0)	-	I (1)	I (1)	I (1)
Guinea-Bissau	I (0)	-	I (1)	I (1)	I (1)
Guyana	I (0)	-	I (1)	I (1)	I (1)
Haiti	I (1)	I (0)	I (1)	I (1)	I (1)
Honduras	I (0)	I (1)	I (0)	I (1)	I (1)
Hungary	I (1)	I (1)	I (0)	I (1)	I (1)
India	I (0)	I (0)	I (0)	I (1)	I (1)
Indonesia	I (0)	I (0)	I (0)	I (1)	I (1)
Iran	I (0)	I (1)	I (0)	I (1)	I (1)
Iraq	I (0)	I (1)	I (1)	I (1)	-
Jamaica	I (0)	I (0)	I (1)	I (1)	I (1)
Jordan	I (1)	I (1)	I (0)	I (1)	I (1)
Kazakhstan	I (0)	I (0)	I (0)	I (1)	I (1)
Kenya	I (0)	I (0)	I (0)	I (1)	I (1)
Kiribati	I (0)	-	I (1)	-	I (1)
Kuwait	I (0)	I (0)	I (1)	I (1)	I (1)
Kyrgyzstan	I (0)	I (1)	I (1)	I (1)	I (1)
Latvia	I (0)	I (1)	I (1)	I (1)	I (1)
Lebanon	I (1)	I (0)	I (0)	I (1)	I (1)

Table 13. Unit root tests using PP approach for developing countries (continued)

Lesotho	I(1)	-	-	I(1)	I(1)
Liberia	I (0)	-	I (0)	I (1)	I (1)
Libya	I (0)	I (1)	I (1)	I (0)	I (1)
Lithuania	I (1)	I (1)	I (1)	I (1)	I (1)
Macedonia	I (1)	I (1)	I (1)	I (1)	I (1)
Madagascar	I (0)	-	I (0)	I (1)	I (1)
Malawi	I (0)	-	I (0)	I (1)	I (1)
Malaysia	I (0)	I (0)	I (0)	I (1)	I (1)
Maldives	I (1)	-	I (0)	I (1)	I (1)
Mali	I (0)	-	I (0)	I (1)	I (1)
Marshall Islands	I (1)	-	I (0)	-	-
Mauritania	I (0)	-	I (1)	I (1)	I (1)
Mauritius	I (0)	-	I (0)	I (1)	I (1)
Mexico	I (1)	I (1)	I (0)	I (1)	I (1)
Federal States of Micronesia	I (0)	-	I (0)	I (1)	-
Moldova	I (0)	I (1)	I (1)	I (1)	I (1)
Mongolia	I (0)	I (0)	I (0)	I (1)	I (1)
Montenegro	I (0)	-	-	I (1)	I (1)
Morocco	I (0)	I (1)	I (0)	I (1)	I (1)
Mozambique	I (1)	I (0)	I (0)	I (1)	I (1)
Namibia	I (1)	I (0)	I (0)	I (1)	I (1)
Nepal	I (0)	I (0)	I (0)	I (1)	I (1)
Nicaragua	I (0)	I (0)	I (0)	I (1)	I (1)
Niger	I (0)	-	I (1)	I (1)	I (1)
Nigeria	I (0)	I (1)	I (1)	I (1)	I (1)
Oman	I (0)	I (0)	I (1)	I (1)	I (1)
Pakistan	I (0)	I (0)	I (0)	I (1)	I (1)
Palau	I (0)	-	I (1)	-	I (1)
Panama	I (0)	I (0)	I (0)	I (1)	I (1)
Papua New Guinea	I (0)	-	I (1)	I (1)	I (1)
Paraguay	I (0)	I (0)	I (0)	I (1)	I (1)
Peru	I (0)	I (0)	I (0)	I (1)	I (1)
Philippines	I (0)	I (0)	I (1)	I (1)	I (1)
Poland	I (1)	I (1)	I (0)	I (1)	I (1)
Qatar	I (1)	I (0)	I (1)	I (1)	I (1)
Romania	I (0)	I (0)	I (0)	I (1)	I (1)
Russia	I (0)	I (1)	I (1)	I (1)	I (1)
Rwanda	I (0)	-	I (0)	I (1)	I (1)

Table 13. Unit root tests using PP approach for developing countries (continued)

St.Kitts and Nevis	I (1)	-	I (0)	I (1)	I (1)
St.Lucia	I (0)	-	I (0)	I (1)	I (1)
St.Vincent and the Grenadines	I (0)	-	I (0)	I (1)	I (1)
Sao Tome and Principe	-	-	I (0)	I (1)	-
Saudi Arabia	I (1)	I (0)	I (1)	I (1)	I (1)
Senegal	I (0)	I (0)	I (1)	I (1)	I (1)
Serbia	I (0)	I (1)	I (0)	I (1)	I (1)
Seychelles	I (1)	-	I (0)	I (1)	I (1)
Sierra Leone	I (0)	-	I (1)	I (1)	I (1)
Solomon Islands	I (0)	-	I (1)	I (1)	I (1)
Somalia	-	-	I (0)	-	I (1)
South Africa	I (0)	I (0)	I (0)	I (1)	I (1)
South Sudan	-	-	-	-	-
Sri Lanka	I (0)	I (0)	I (0)	I (1)	I (1)
Sudan	I (0)	I (1)	I (0)	I (1)	I (1)
Suriname	I (0)	-	I (1)	I (1)	I (1)
Swaziland	I (0)	-	I (0)	I (1)	I (1)
Syria	I (0)	I (0)	I (0)	I (1)	I (1)
Tajikistan	I (0)	I (1)	I (1)	I (1)	I (1)
Tanzania	I (0)	I (0)	I (0)	I (1)	I (1)
Thailand	I (0)	I (0)	I (1)	I (1)	I (1)
Togo	I (1)	I (0)	I (1)	I (1)	I (1)
Tonga	I (1)	-	I (1)	I (1)	I (1)
Trinidad and Tobago	I (0)	I (0)	I (1)	I (1)	I (1)
Tunisia	I (0)	I (1)	I (1)	I (1)	I (1)
Turkey	I (0)	I (0)	I (1)	I (1)	I (1)
Turkmenistan	I (0)	I (1)	I (0)	I (1)	I (1)
Tuvalu	I (0)	-	-	-	-
Uganda	I (1)	-	I (0)	I (1)	I (1)
Ukraine	I (0)	I (1)	I (1)	I (1)	I (1)
UAE	I (0)	I (1)	I (1)	I (1)	I (1)
Uruguay	I (0)	I (0)	I (0)	I (1)	I (1)
Uzbekistan	I (0)	I (0)	I (0)	I (0)	I (0)
Vanuatu	I (0)	-	I (1)	-	I (1)
Venezuela	I (0)	I (1)	I (1)	I (1)	I (1)
Vietnam	I (1)	I (0)	I (1)	I (1)	I (1)
Yemen	I (1)	I (1)	I (1)	I (1)	I (1)
Zambia	I (0)	I (1)	I (1)	I (1)	I (1)
Zimbabwe	I (0)	I (0)	I (1)	I (1)	I (1)

Table 15. Unit root tests using PP approach for developed countries

Country	ln GDP	ln ENERGY	ln CO2	ln FD	ln TRD
Australia	I (1)	I (1)	I (1)	I (1)	I (1)
Austria	I (1)	I (1)	I (1)	I (1)	I (1)
Belgium	I (1)	I (1)	I (0)	I (1)	I (1)
Canada	I (1)	I (1)	I (1)	I (1)	I (1)
Cyprus	I (1)	I (0)	I (1)	I (1)	I (1)
Czech Republic	I (1)	I (0)	I (1)	I (1)	I (1)
Denmark	I (1)	I (1)	I (1)	I (1)	I (1)
Estonia	I (0)	I (1)	I (1)	I (1)	I (1)
Finland	I (0)	I (1)	I (1)	I (1)	I (1)
France	I (1)	I (1)	I (1)	I (1)	I (1)
Germany	I (1)	I (1)	I (1)	I (1)	I (1)
Greece	I (1)	I (1)	I (1)	I (1)	I (1)
Hong Kong	I (1)	I (1)	I (1)	I (1)	I (1)
Iceland	I (0)	I (0)	I (1)	I (1)	I (1)
Ireland	I (0)	I (0)	I (1)	I (1)	I (1)
Israel	I (1)	I (1)	I (0)	I (1)	I (1)
Italy	I (1)	I (1)	I (1)	I (1)	I (1)
Japan	I (1)	I (1)	I (1)	I (1)	I (1)
Luxembourg	I (0)	I (0)	I (0)	I (1)	I (1)
Malta	I (1)	I (0)	I (0)	I (1)	I (1)
Netherlands	I (1)	I (1)	I (1)	I (1)	I (1)
New Zealand	I (0)	I (1)	I (0)	I (1)	I (1)
Norway	I (1)	I (1)	I (0)	I (1)	I (1)
Portugal	I (1)	I (1)	I (1)	I (1)	I (1)
San Marino	I (0)	-	-	-	-
Singapore	I (0)	I (0)	I (0)	I (1)	I (1)
Slovakia	I (0)	I (1)	I (1)	I (1)	I (1)
Slovenia	I (1)	I (0)	I (0)	I (1)	I (1)
Spain	I (1)	I (1)	I (1)	I (1)	I (1)
Sweden	I (1)	I (1)	I (0)	I (1)	I (1)
Switzerland	I (0)	I (1)	I (1)	I (1)	I (1)
UK	I (0)	I (1)	I (0)	I (1)	I (1)
US	I (1)	I (1)	I (1)	I (1)	I (1)

Table 16.Bound test result of Bangladesh.

		Without Determintic Trends		
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
1	2.645706	0.0496	-3.394082372198855	0.0025
2	2.087808	0.1171	-2.619818022932288	0.0179
3	1.483143	0.2717	-1.79955379063375	0.0994
4	1.036583	0.4848	0.2981804368243452	0.7776

		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			4.098161	0.0088	-4.436492379010765	0.0002
2			2.515966	0.0730	-3.13714432177192	0.0064
3			2.790723	0.0786	-2.708606934382131	0.0220
4			1.997885	0.2611	-0.4945195135328728	0.6469

Table 17. Bound test result of China.

		Without Determintic Trends				
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
3	3.758295	0.0383	-2.059292	0.0601		
4	4.119343	0.0383	-1.712115	0.1177		
5	3.644981	0.0721	-1.435560	0.1943		
6	3.570556	0.1253	-0.113937	0.9148		
		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
3	2.604189	0.0891	2.812479	0.0845	-1.338274	0.2056
4	3.071182	0.0748	3.360683	0.0688	-1.146848	0.2810
5	4.885280	0.0427	6.501932	0.0258	-0.969169	0.3699
6	5.916027	0.0880	7.754905	0.0632	0.033798	0.9752

Table 18. Bound test result of Colombia.

		Without Determintic Trends				
p	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	3.164821	0.0406	-3.007702	0.0056		
2	2.681387	0.0706	-2.757035	0.0112		
3	1.437258	0.2632	-1.939211	0.0675		
4	0.899837	0.4642	-0.433328	0.6709		
		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
2	4.584242	0.0076	6.089033	0.0035	-3.979228	0.0006
3	2.929363	0.0499	3.903317	0.0261	-3.185612	0.0051
4	1.749566	0.1952	2.265795	0.1257	-1.806361	0.0924
5	3.140319	0.0647	4.186979	0.0367	-2.528740	0.0299

Table 19.Bound test result of Cote D’Ivore.

Without Determintic Trends

P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
1	2.415341	0.0671	-3.226077962480241	0.0037
2	1.562595	0.2236	-2.395959076638313	0.0284
3	2.973618	0.0613	-2.177737995754777	0.0521
4	2.064170	0.2227	-0.7440120600795186	0.4903

With Determintic Trends

P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			2.197248	0.0913	-2.974855114321474	0.0070
2			1.307791	0.3097	-2.076923164150085	0.0543
3			2.159622	0.1405	-1.440829452263457	0.1802
4			2.147836	0.2394	0.04548090804993539	0.9659

Table 20. Bound test result of Ghana.

		Without Determintic Trends				
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	7.862680	0.0002	-5.176017	0.0000		
2	1.947859	0.1389	-1.221533	0.2386		
3	9.666909	0.0010	-3.061720	0.0108		
4	3.233644	0.1118	-2.817058	0.0372		
		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			7.205431	0.0004	-4.985553	0.0001
2			1.360208	0.2905	-1.266802	0.2234
3			8.872871	0.0019	-4.054773	0.0023
4			2.532652	0.1944	-1.928585	0.1260

Table 21.Bound test result of Nigeria.

		Without Determintic Trends				
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
2	4.582580	0.0055	-3.977617	0.0007		
3	4.385164	0.0116	-4.448043	0.0005		
4	1.631210	0.2465	-1.760572	0.1122		
5	3.385819	0.1722	-0.469840	0.6705		
		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
2			3.831680	0.0135	-3.725482	0.0013
3			4.820622	0.0090	-4.666105	0.0004
4			2.209143	0.1526	-2.399819	0.0432
5			2.417287	0.3181	-0.494946	0.6697

Table 22. Bound test result of Oman.

Without Determintic Trends

P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
1	2.234520	0.0823	-2.111263	0.0449
2	7.559563	0.0005	-4.029604	0.0007
3	2.146792	0.1240	-0.680987	0.5078
4	3.442055	0.0689	2.162388	0.0674

With Determintic Trends

P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			3.006107	0.0302	-2.585784	0.0162
2			11.69350	0.0000	-5.571128	0.0000
3			5.463803	0.0075	-3.195397	0.0077
4			11.86283	0.0046	-0.747247	0.4832

Table 23. Bound test result of Saudi Arabia.

Without Determintic Trends

P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
4	5.724093	0.0114	-4.127390	0.0014
5	1.939637	0.1938	-2.146880	0.0603
6	1.955628	0.2221	-1.848977	0.1140
7	2.583669	0.2281	-2.386890	0.0970

With Determintic Trends

P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
4	7.949266	0.0029	10.59115	0.0014	-5.550323	0.0002
5	3.362388	0.0679	4.449696	0.0406	-3.418367	0.0091
6	3.893043	0.0842	4.987143	0.0579	-3.258130	0.0225
7	30.64653	0.0318	36.90665	0.0265	-8.502755	0.0136

Table 24. Bound test result of Senegal.

Without Determintic Trends

P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
2	3.129858	0.0289	-2.125241	0.0456
3	1.973002	0.1414	-1.995719	0.0645
4	4.853904	0.0198	-3.082408	0.0131
5	4.170012	0.1347	-1.327217	0.2764

With Determintic Trends

P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
2			3.490916	0.0198	-2.469159	0.0227
3			1.894494	0.1592	-1.893047	0.0792
4			4.563755	0.0289	-2.795527	0.0234
5			4.375063	0.1964	-1.517527	0.2684

Table 25.Bound test result of Thailand.

Without Determintic Trends

P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
2	1.461080	0.2444	-0.613343	0.5462
3	2.653668	0.0653	0.153562	0.8800
4	1.945847	0.1818	0.511655	0.6212
5	2.204442	0.2738	0.303515	0.7813

With Determintic Trends

P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			2.675568	0.0443	-2.694367	0.0122
2			1.384969	0.2719	-1.510122	0.1467
3			3.398067	0.0322	-1.221777	0.2420
4			2.901699	0.0874	-1.350748	0.2137

Table 26. Bound test result of Togo.

		Without Determintic Trends				
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	6.034366	0.0007	-4.709579	0.0001		
2	2.660603	0.0515	-3.261660	0.0037		
3	2.084261	0.1242	-2.588983	0.0205		
4	7.267455	0.0055	-3.265979	0.0097		
		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			8.391996	0.0001	-5.658311	0.0000
2			4.127317	0.0097	-4.086951	0.0006
3			2.485185	0.0823	-2.862668	0.0125
4			18.35261	0.0003	-5.701139	0.0005

Table 27. Bound test result of Trinidad and Tobago.

		Without Determintic Trends				
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	1.954448	0.1181	-2.901805	0.0073		
2	1.943377	0.1296	-2.381516	0.0268		
3	0.764239	0.5895	-0.118527	0.9072		
4	0.989285	0.4748	-0.188282	0.8548		
		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
2			5.118452	0.0035	-4.409737	0.0003
3			3.083397	0.0440	-1.972001	0.0687
4			4.052238	0.0395	-1.776742	0.1135
5			7.760509	0.1181	-3.882990	0.0604

Table 28. Bound test result of Tunisia.

		Without Determintic Trends		
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
1	7.453596	0.0002	-5.640492	0.0000
2	2.306591	0.0809	-3.175904	0.0046
3	1.616272	0.2158	-2.678926	0.0172
4	2.175906	0.1467	-2.917131	0.0171

		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			7.256438	0.0002	-5.924507	0.0000
2			2.875324	0.0409	-3.466023	0.0024
3			2.345352	0.0959	-2.972391	0.0101
4			2.015955	0.1804	-2.810143	0.0228

Table 29. Bound test result of Turkey.

		Without Determintic Trends		
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
2	4.339895	0.0041	-1.267153	0.2145
3	3.030576	0.0284	-1.317320	0.1997
4	2.955953	0.0387	0.152703	0.8802
5	0.548508	0.7370	-0.713016	0.4884

		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
3			3.896697	0.0100	-2.514841	0.0190
4			7.198663	0.0007	-2.982559	0.0080
5			2.044511	0.1439	-2.626568	0.0221
6			1.101484	0.4465	-0.663249	0.5318

Table 30. Bound test result of Venezuela.

		Without Determintic Trends				
p	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	2.533079	0.0527	-3.004239	0.0057		
2	2.506016	0.0627	-2.520713	0.0199		
3	2.214388	0.1069	-1.999593	0.0640		
4	4.408498	0.0263	-3.468784	0.0071		
		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
2			4.623456	0.0058	-3.961071	0.0008
3			2.424159	0.0879	-2.276320	0.0391
4			4.805801	0.0252	-3.322371	0.0105
5			0.139851	0.9658	0.313200	0.7838

Table 31. Bound test result of Zambia.

		Without Determintic Trends				
p	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
2	2.257383	0.0862	-2.592147	0.0170		
3	1.495693	0.2494	-1.380086	0.1878		
4	1.514267	0.2770	-1.315480	0.2209		
5	6.482977	0.0774	1.907909	0.1524		
		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			5.940994	0.0009	-5.002568	0.0000
2			2.850265	0.0422	-3.060542	0.0062
3			1.735102	0.1913	-1.750567	0.1019
4			1.330860	0.3419	-1.798564	0.1098

Table 32. Bound test result of Australia.

		Without Determintic Trends		
p	F_iii	p-val F_iii*	t_iii	p-val t_iii*
1	1.974465	0.1054	-2.620429	0.0127
2	1.333290	0.2763	-2.036825	0.0503
3	1.768547	0.1560	-2.443439	0.0219
4	0.922143	0.4881	-1.575678	0.1316

		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			2.109179	0.0867	-3.160121	0.0032
2			2.031320	0.1026	-3.058684	0.0046
3			2.810431	0.0390	-3.559802	0.0016
4			1.072322	0.4081	-1.963055	0.0653

Table 33. Bound test result of Austria.

		Without Determintic Trends		
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
1	5.198044	0.0010	-4.917386	0.0000
2	3.405109	0.0141	-3.840812	0.0005
3	1.574982	0.2021	-2.487224	0.0196
4	2.148525	0.1012	-2.788035	0.0114

		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			6.637561	0.0002	-5.561065	0.0000
2			3.758113	0.0089	-4.102155	0.0003
3			2.060454	0.1044	-2.956173	0.0067
4			1.677547	0.1884	-2.833543	0.0106

Table 34. Bound test result of Canada.

		Without Determintic Trends					
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*			
3	4.031098	0.0081	-0.666485	0.5112			
4	5.140214	0.0038	-1.792238	0.0890			
5	4.370607	0.0149	-2.720142	0.0175			
6	1.807854	0.2300	-2.180779	0.0656			
		With Determintic Trends					
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*	
3			4.178216	0.0071	-0.271328	0.7885	
4			4.256758	0.0099	-1.130309	0.2732	
5			3.399950	0.0382	-1.479619	0.1647	
6			3.496912	0.0797	-0.296457	0.7769	

Table 35. Bound test result of Cyprus.

		Without Determintic Trends					
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*			
1	4.936523	0.0032	-3.904805	0.0007			
2	2.713803	0.0558	-2.867782	0.0107			
3	6.319998	0.0053	-4.879064	0.0005			
4	1.723498	0.2824	-1.163752	0.2970			
		With Determintic Trends					
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*	
1			4.343506	0.0067	-3.699338	0.0013	
2			2.324217	0.0910	-2.747845	0.0143	
3			6.247399	0.0070	-4.877101	0.0006	
4			0.763562	0.6202	-1.026814	0.3625	

Table 36. Bound test result of Denmark.

		Without Determintic Trends		
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
2	5.705569	0.0008	-5.146007	0.0000
3	4.157973	0.0069	-4.105310	0.0004
4	1.619183	0.2030	-2.503498	0.0216
5	3.529476	0.0310	-4.082850	0.0013

		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
3			4.160228	0.0073	-4.245311	0.0003
4			1.419838	0.2645	-2.335812	0.0313
5			3.606542	0.0319	-4.111224	0.0014
6			3.270431	0.0907	-1.536290	0.1754

Table 37. Bound test result of Finland.

		Without Determintic Trends		
p	F_iii	p-val F_iii*	t_iii	p-val t_iii*
1	1.578407	0.1903	-1.974618	0.0558
2	1.253655	0.3086	-1.392084	0.1738
3	0.824014	0.5444	-0.623692	0.5385
4	0.518270	0.7593	-0.422857	0.6771

		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			2.063581	0.0929	-2.495656	0.0173
2			1.650057	0.1773	-1.941106	0.0617
3			1.330138	0.2853	-1.414146	0.1702
4			0.318109	0.8956	-0.765831	0.4537

Table 38. Bound test result of France.

		Without Determintic Trends				
p	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	1.030085	0.4139	-0.991286	0.3278		
2	1.673437	0.1695	-0.902773	0.3734		
3	2.307109	0.0733	-1.166865	0.2539		
4	2.322132	0.0812	-0.126266	0.9008		
		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
4			1.137992	0.3746	0.169849	0.8669
5			1.243909	0.3443	0.047954	0.9625
6			1.671912	0.2587	0.001759	0.9986
7			1.509844	0.5473	1.108153	0.4674

Table 39. Bound test result of Greece.

		Without Determintic Trends				
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	3.416249	0.0120	-3.618815	0.0009		
2	2.801558	0.0330	-2.619090	0.0134		
3	4.134295	0.0068	-2.393633	0.0242		
4	3.223521	0.0270	-2.628916	0.0161		
		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
3			2.444776	0.0619	-2.596235	0.0156
4			1.862379	0.1487	-2.670285	0.0151
5			4.353327	0.0151	-3.826257	0.0021
6			1.651291	0.2634	-2.458896	0.0435

Table 40. Bound test result of Iceland.

		Without Determintic Trends		
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
1	6.206832	0.0003	-4.578441	0.0001
2	2.826986	0.0324	-3.433990	0.0017
3	4.310801	0.0058	-3.730302	0.0010
4	2.115155	0.1079	-2.366130	0.0288

		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			5.850149	0.0005	-4.506086	0.0001
2			2.702845	0.0393	-3.359390	0.0021
3			4.009483	0.0087	-3.720799	0.0011
4			1.919858	0.1408	-2.343863	0.0308

Table 41. Bound test result of Italy.

		Without Determintic Trends		
p	F_iii	p-val F_iii*	t_iii	p-val t_iii*
1	2.686739	0.0371	-2.593097	0.0138
2	2.776804	0.0362	-3.022637	0.0052
3	1.753543	0.1625	-2.763607	0.0111
4	1.109006	0.3921	-1.654043	0.1165

		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
2			5.297453	0.0015	-4.915527	0.0000
3			9.373596	0.0001	-6.759835	0.0000
4			6.661963	0.0016	-5.156517	0.0001
5			5.753466	0.0093	-4.638596	0.0009

Table 42. Bound test result of Japan.

P	F_iii	p-val F_iii*	t_iii	p-val t_iii*
		Without Determintic Trends		
3	7.009001	0.0003	-4.703414	0.0001
4	3.374586	0.0238	-3.588568	0.0020
5	3.665325	0.0274	-3.549710	0.0036
6	3.060921	0.0885	-1.312057	0.2309

P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
		With Determintic Trends				
3			7.036194	0.0004	-2.290125	0.0311
4			3.309622	0.0271	-2.224462	0.0391
5			3.123818	0.0492	-2.763996	0.0172
6			2.616592	0.1366	-1.192123	0.2782

Table 43. Bound test result of Netherlands.

p	F_iii	p-val F_iii*	t_iii	p-val t_iii*
		Without Determintic Trends		
1	1.385182	0.2523	-2.129226	0.0400
2	1.186901	0.3382	-1.850822	0.0737
3	2.690013	0.0445	-2.834364	0.0090
4	1.766887	0.1680	-0.980182	0.3393

p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
		With Determintic Trends				
3			5.510444	0.0016	-2.128163	0.0438
4			4.676794	0.0065	-0.970045	0.3449
5			4.880523	0.0114	-2.446167	0.0308
6			8.098977	0.0121	-1.757422	0.1294

Table 44. Bound test result of Portugal.

		Without Determintic Trends				
p	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	3.317225	0.0139	-3.839037	0.0005		
2	2.749122	0.0355	-3.374089	0.0020		
3	1.451110	0.2397	-2.184253	0.0382		
4	1.842669	0.1501	-2.741329	0.0126		
		With Determintic Trends				
p	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1			3.489612	0.0110	-3.937353	0.0004
2			3.270435	0.0174	-3.479727	0.0015
3			1.710974	0.1689	-2.117660	0.0443
4			2.363402	0.0792	-2.601113	0.0175

Table 45. Bound test result of Spain.

		Without Determintic Trends				
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	3.375359	0.0128	-3.575258	0.0010		
2	1.319163	0.2809	-2.133257	0.0407		
3	1.180172	0.3457	-0.759467	0.4544		
4	1.180773	0.3533	-0.216285	0.8310		
		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
3			4.561621	0.0043	-2.294560	0.0304
4			3.483167	0.0211	-2.328326	0.0311
5			0.563195	0.7267	-0.554052	0.5889
6			0.788251	0.5896	-0.633345	0.5466

Table 46. Bound test result of US.

		Without Determintic Trends				
P	F_iii	p-val F_iii*	t_iii	p-val t_iii*		
1	4.334408	0.0098	-3.122732	0.0033		
2	3.976307	0.0152	-3.080379	0.0039		
3	3.411492	0.0291	-2.695079	0.0111		
4	4.559123	0.0101	-2.802397	0.0091		
		With Determintic Trends				
P	F_iv	p-val F_iv*	F_v	p-val F_v*	t_v	p-val t_v*
1	3.395221	0.0178	3.488590	0.0246	-3.083577	0.0037
2	3.888009	0.0103	3.831943	0.0179	-3.151662	0.0033
3	3.364834	0.0213	3.404451	0.0298	-2.956835	0.0059
4	3.917961	0.0123	4.389361	0.0122	-3.088771	0.0046

Table 47. Critical Values for ARDL Testing Approach for Bangladesh (33 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_V	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model unlimited intercept and trend manifest by F_V , F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 48. Critical Values for ARDL Testing Approach for China (26 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.097	4.118	3.715	4.878	5.205	6.640
F_V	3.430	4.624	4.154	5.540	5.856	7.578
F_{III}	2.752	3.994	3.354	4.774	4.768	6.670
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 49. Critical Values for ARDL Testing Approach for Colombia (29 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.097	4.118	3.715	4.878	5.205	6.640
F_V	3.430	4.624	4.154	5.540	5.856	7.578
F_{III}	2.752	3.994	3.354	4.774	4.768	6.670
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 50. Critical Values for ARDL Testing Approach for Cote D'Ivore (33 obs)

K = 4	0.10 I (0)	0.10 I (1)	0.05 I (0)	0.05 I (1)	0.01 I (0)	0.01 I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_V	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 51. Critical Values for ARDL Testing Approach for Ghana (30 obs)

k = 4	0.10 I (0)	0.10 I (1)	0.05 I (0)	0.05 I (1)	0.01 I (0)	0.01 I (1)
F_{IV}	3.097	4.118	3.715	4.878	5.205	6.640
F_V	3.430	4.624	4.154	5.540	5.856	7.578
F_{III}	2.752	3.994	3.354	4.774	4.768	6.670
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 52. Critical Values for ARDL Testing Approach for Nigeria (33 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_{V}	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_{V}	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 53. Critical Values for ARDL Testing Approach for Oman (35 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_{V}	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_{V}	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 54. Critical Values for ARDL Testing Approach for Saudi Arabia (29 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.097	4.118	3.715	4.878	5.205	6.640
F_V	3.430	4.624	4.154	5.540	5.856	7.578
F_{III}	2.752	3.994	3.354	4.774	4.768	6.670
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 55. Critical Values for ARDL Testing Approach for Senegal (37 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_V	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 56. Critical Values for ARDL Testing Approach for Thailand (36 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_V	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 57. Critical Values for ARDL Testing Approach for Togo (37 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_V	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 58. Critical Values for ARDL Testing Approach for Trinidad and Tobago (37 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_V	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 59. Critical Values for ARDL Testing Approach for Tunisia (37 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_V	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 60. Critical Values for ARDL Testing Approach for Turkey (47 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable f in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V
, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 61. Critical Values for ARDL Testing Approach for Venezuela (37 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_V	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 62. Critical Values for ARDL Testing Approach for Zambia (37 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_{V}	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_{V}	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 63. Critical Values for ARDL Testing Approach for Australia (47 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_{V}	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_{V}	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 64. Critical Values for ARDL Testing Approach for Austria (43 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 65. Critical Values for ARDL Testing Approach for Canada (46 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 66.Critical Values for ARDL Testing Approach for Cyprus (33 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.035	3.997	3.578	4.668	5.147	6.617
F_{V}	3.374	5.304	4.036	5.304	5.604	7.174
F_{III}	2.696	3.898	3.274	4.630	4.590	6.368
t_{V}	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 67. Critical Values for ARDL Testing Approach for Denmark (47 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_{V}	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_{V}	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 68. Critical Values for ARDL Testing Approach for Finland (47 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 69. Critical Values for ARDL Testing Approach for France (43 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 70. Critical Values for ARDL Testing Approach for Greece (44 obs)

K = 4	0.10 I (0)	0.10 I (1)	0.05 I (0)	0.05 I (1)	0.01 I (0)	0.01 I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 71. Critical Values for ARDL Testing Approach for Iceland (47 obs)

K = 4	0.10 I (0)	0.10 I (1)	0.05 I (0)	0.05 I (1)	0.01 I (0)	0.01 I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 72. Critical Values for ARDL Testing Approach for Italy (45 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_{V}	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_{V}	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 73. Critical Values for ARDL Testing Approach for Japan (28 obs)

	0.10		0.05		0.01	
k = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	3.097	4.118	3.715	4.878	5.205	6.640
F_{V}	3.430	4.624	4.154	5.540	5.856	7.578
F_{III}	2.752	3.994	3.354	4.774	4.768	6.670
t_{V}	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 74. Critical Values for ARDL Testing Approach for Netherlands (47 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 75. Critical Values for ARDL Testing Approach for Portugal (43 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}. (2) t ratios denote by t_V and t_{III}.

Table 76. Critical Values for ARDL Testing Approach for Spain (43 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V , F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 77. Critical Values for ARDL Testing Approach for US (43 obs)

	0.10		0.05		0.01	
K = 4	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
F_{IV}	2.950	3.862	3.470	4.470	4.628	5.865
F_V	3.298	4.378	3.890	5.104	5.224	6.696
F_{III}	2.638	3.772	3.178	4.450	4.394	5.914
t_V	-3.13	-3.63	-3.41	-3.95	-3.96	-4.53
t_{III}	-2.57	-3.21	-2.86	-3.53	-3.43	-4.10

NOTES: (1) k is the number of regressors of dependent variable in ARDL testing approach. F ratio of the model with unlimited intercept and unlimited trend manifest by $F_{IV,}$ F ratio of the model unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III} . (2) t ratios denote by t_V and t_{III}.

Table 78. The Bounds Test for Level Relationships for Developing Countries

	With Deterministic Trends		Without Deterministic Trend	
Variables	F_{IV}	F_{V}	F_{III}	Conclusion
				H_0
(1) Bangladesh				Inconclusive
p = 1*	-	4.10b	2.65a	
2	-	2.52a	2.09a	
3	-	2.79a	1.48a	
4	-	2.00a	1.04a	
(2) China				Reject
p=3*	2.60a	2.81a	3.76b	
4	3.07b	3.60b	4.12c	
5	4.89c	6.50c	3.65b	
6	5.92c	7.75c	3.57b	
(3) Colombia				Reject
p=1*	4.58c	6.09c	3.16b	
2	2.93a	3.90b	3.68b	
3	1.75a	2.27a	1.44a	
4	3.14b	4.19b	0.90a	
(4) Cote D'Ivore				Inconclusive
p=1*	-	2.20a	2.42a	
2	-	1.31a	1.56a	
3	-	2.16a	2.97b	
4	-	2.15a	2.06a	
(5) Ghana				Reject
p=1*	-	7.21c	7.86c	
2	-	1.36a	1.95a	
3	-	8.87c	9.67c	
4	-	2.53a	3.23b	

*Note: Optimum required lag numbers in the bound test were selected by Akaike Information Criterion (AIC) and Schwartz Criteria (SC). In each model p and * were suggested by AIC and SC, where p denotes lag levels and * expresses optimum lag selection. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model with unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}.*

Table 77. The Bounds Test for Level Relationships for Developing Countries (continued)

Variables	With Deterministic Trends F_{IV}	F_V	Without Deterministic Trend F_{III}	Conclusion
(6) Nigeria				Reject
p=2*	-	3.83b	4.58c	
3	-	4.82c	4.39c	
4	-	2.21a	1.63a	
5	-	2.42a	3.39b	
(7) Oman				Reject
p=1*	-	3.01a	2.23a	
2	-	11.69c	7.56c	
3	-	5.46c	2.15a	
4	-	11.86c	3.44c	
(8) Saudi Arabia				Reject
p=4*	7.95c	10.59c	5.72c	
5	3.36b	4.45b	1.94a	
6	3.89b	4.99c	1.96a	
7	30.65c	36.91c	2.58a	
(9) Senegal				Reject
p=2*	-	3.49b	3.13b	
3	-	1.89a	1.97a	
4	-	4.56c	4.85c	
5	-	4.38b	4.17c	
(10) Thiland				Iconclusive
p=2*	-	2.68a	1.46a	
3	-	1.38a	2.65a	
4	-	3.40b	1.95a	
5	-	2.90a	2.20a	
(11) Togo				Reject
p=1*	-	8.39c	6.03c	
2	-	4.12b	2.66a	
3	-	2.48a	2.08a	
4	-	18.35c	7.27c	

*Note: Optimum required lag numbers in the bound test were selected by Akaike Information Criterion (AIC) and Schwartz Criteria (SC). In each model p and * were suggested by AIC and SC, where p denotes lag levels and * expresses optimum lag selection. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model with unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}.*

Table 77. The Bounds Test for Level Relationships for Developing Countries (continued)

Variables	With Deterministic Trends F_{IV}	F_V	Without Deterministic Trend F_{III}	Conclusion
(12) Trinidad and Tobago				Reject
p=1*	-	5.11c	1.95a	
2	-	3.08a	1.94a	
3	-	4.05b	0.76a	
4	-	7.76c	0.99a	
(13) Tunisia				Reject
p=1*	-	7.26c	7.45c	
2	-	2.88a	2.30a	
3	-	2.35a	1.61a	
4	-	2.02a	2.18a	
(14) Turkey				Reject
p=2*	-	3.90b	4.34c	
3	-	7.20c	3.03b	
4	-	2.05a	2.96b	
5	-	1.10a	0.55a	
(15) Venezuela				Reject
p=1*	-	4.62c	2.53a	
2	-	2.42a	2.51a	
3	-	4.81c	2.21a	
4	-	0.14a	4.41c	
(16) Zambia				Reject
p=2*	-	5.94c	2.56a	
3	-	2.85a	1.50a	
4	-	1.74a	1.51a	
5	-	1.33a	6.48c	

*Note: Optimum required lag numbers in the bound test were selected by Akaike Information Criterion (AIC) and Schwartz Criteria (SC). In each model p and * were suggested by AIC and SC, where p denotes lag levels and * expresses optimum lag selection. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model with unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}.*

Table 79. The Bounds Test for Level Relationships for Developed Countries

	With Deterministic Trends		Without Deterministic Trend	
Variables	F_{IV}	F_{V}	F_{III}	Conclusion
				H_0
(1) Australia				Accept
P = 1*	-	2.11a	1.97a	
2	-	2.03a	1.33a	
3	-	2.81a	1.77a	
4	-	1.07a	0.92a	
(2) Austria				Reject
P = 1*	-	6.64c	5.20c	
2	-	3.76b	3.41b	
3	-	2.06a	1.58a	
4	-	1.68a	2.15a	
(3) Canada				Reject
p=3*	-	4.18b	4.03c	
4	-	4.26b	5.14c	
5	-	3.40b	4.37c	
6	-	4.50c	1.81a	
(4) Cyprus				Reject
p=1*	-	4.34b	4.93c	
2	-	2.32a	2.71b	
3	-	6.25c	6.32c	
4	-	0.76a	1.72a	
(5) Denmark				Reject
p=2*	-	4.16b	5.71c	
3	-	1.42a	4.16c	
4	-	3.61b	1.62a	
5	-	3.27a	3.53b	

*Note: Optimum required lag numbers in the bound test were selected by Akaike Information Criterion (AIC) and Schwartz Criteria (SC). In each model p and * were suggested by AIC and SC, where p denotes lag levels and * expresses optimum lag selection. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model with unlimited intercept and trend manifest by F_{V}, F ratio of the model only with unlimited intercept manifest by F_{III}.*

Table 78.The Bounds Test for Level Relationships for Developing Countries (cont.)

Variables	With Deterministic Trends F_{IV}	F_V	Without Deterministic Trend F_{III}	Conclusion
(6) Finland				Accept
p=1*	-	2.06a	1.58a	
2	-	1.65a	1.25a	
3	-	1.33a	0.82a	
4	-	0.32a	0.52a	
(7) France				Accept
P=1*	-	1.14a	1.03a	
2	-	1.24a	1.67a	
3	-	1.67a	2.31a	
4	-	1.51a	2.32a	
(8) Greece				Reject
P=1*	-	2.45a	3.42b	
2	-	1.86a	2.80b	
3	-	4.35b	4.13c	
4	-	1.65a	3.22b	
(9) Iceland				Reject
P=1*	-	5.85c	6.21c	
2	-	2.70a	2.70b	
3	-	4.01b	4.01c	
4	-	1.92a	1.92a	
(10) Italy				Reject
P=1*	-	5.30c	2.69b	
2	-	9.37c	2.78b	
3	-	6.66c	1.75a	
4	-	5.75c	1.11a	

*Note: Optimum required lag numbers in the bound test were selected by Akaike Information Criterion (AIC) and Schwartz Criteria (SC). In each model p and * were suggested by AIC and SC, where p denotes lag levels and * expresses optimum lag selection. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model with unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}.*

Table 78.The Bounds Test for Level Relationships for Developing Countries (cont.)

	With Deterministic Trends		Without Deterministic Trend	
Variables	F_{IV}	F_V	F_{III}	Conclusion
(11) Japan				Reject
p=3*	-	7.04c	7.01c	
4	-	3.31b	3.37b	
5	-	3.12a	3.67b	
6	-	2.62a	3.06b	
(12) Netherlands				Reject
p=1*	-	5.51c	1.39a	
2	-	4.68c	1.19a	
3	-	4.88c	2.69b	
4	-	8.10c	1.77a	
(13) Portugal				Inconclusive
p=1*	-	3.49b	3.32b	
2	-	3.27a	2.75b	
3	-	1.71a	1.45a	
4	-	2.36a	1.84a	
(14) Spain				Reject
p=1*	-	4.56c	3.38b	
2	-	3.48b	1.32a	
3	-	0.56a	1.18a	
4	-	0.79a	1.18a	
(15) US				Reject
p=1*	3.40b	3.49b	4.33c	
2	3.89c	3.83b	3.98c	
3	3.37b	3.41b	3.41b	
4	3.92c	4.39c	4.56c	

*Note: Optimum required lag numbers in the bound test were selected by Akaike Information Criterion (AIC) and Schwartz Criteria (SC). In each model p and * were suggested by AIC and SC, where p denotes lag levels and * expresses optimum lag selection. F ratio of the model with unlimited intercept and unlimited trend manifest by F_{IV}, F ratio of the model with unlimited intercept and trend manifest by F_V, F ratio of the model only with unlimited intercept manifest by F_{III}.*

Table 80. Level Equation with Constant and Trend (for China)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.235456	0.201135	1.170640	0.2543
LTRD	0.006462	0.040278	0.160422	0.8740
LFD	0.210679	0.130784	1.610888	0.1215
LENERGY	0.988038	0.182043	5.427491	0.0000
C	-4.330740	5.376249	-0.805532	0.4291

Table 81. Level Equation with Constant and Trend (for Colombia)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.439621	0.540582	-0.813237	0.4223
LTRD	0.373390	0.145532	2.565693	0.0154
LFD	0.687494	0.293823	2.339828	0.0259
LENERGY	0.967829	0.182257	5.310238	0.0000
C	12.02907	11.85509	1.014675	0.3181

Table 82. Level Equation with Constant and Trend (for Ghana)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.758691	0.177647	4.270775	0.0002
LTRD	-0.121830	0.081447	-1.495826	0.1455
LFD	-0.159359	0.097433	-1.635574	0.1127
LENERGY	1.658982	0.236804	7.005721	0.0000
C	-21.66674	3.088019	-7.016386	0.0000

Table 83. Level Equation with Constant and Trend (for Nigeria)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.954691	1.059159	-0.901367	0.3739
LTRD	-1.955263	0.360612	-5.422062	0.0000
LFD	-1.588772	0.450770	-3.524573	0.0013
LENERGY	10.68611	3.562852	2.999313	0.0051
C	-74.47240	43.35019	-1.717926	0.0952

Table 84. Level Equation with Constant and Trend (for Oman)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-15.18596	20.38187	-0.745072	0.4618
LTRD	-15.51550	21.97225	-0.706141	0.4854
LFD	3.648367	6.304865	0.578659	0.5670
LNERGY	-0.237139	0.663276	-0.357527	0.7231
C	410.0931	548.3259	0.747900	0.4602

Table 85. Level Equation with Constant and Trend (for Saudi Arabia)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.255037	0.150858	1.690578	0.1024
LTRD	0.310136	0.198166	1.565027	0.1292
LFD	0.039787	0.054401	0.731362	0.4709
LENERGY	0.610328	0.190119	3.210235	0.0034
C	-8.288083	6.371402	-1.300826	0.2043

Table 86. Level Equation with Constant and Trend (for Senegal)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-2.658661	0.425736	-6.244863	0.0000
LTRD	-0.113876	0.108541	-1.049152	0.3017
LFD	-0.222547	0.088662	-2.510059	0.0172
LENERGY	2.903580	0.409375	7.092718	0.0000
C	44.07684	8.394347	5.250777	0.0000

Table 87. Level Equation with Constant and Trend (for Togo)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-1.712095	0.428857	-3.992225	0.0003
LTRD	-0.078422	0.107327	-0.730684	0.4701
LFD	1.411894	0.132558	10.65116	0.0000
LENERGY	6.383996	0.714645	8.933098	0.0000
C	4.261011	7.009623	0.607880	0.5474

Table 88. Level Equation with Constant and Trend (for Trinidad and Tobago)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.020191	0.641065	-0.031496	0.9751
LTRD	-0.715988	0.256319	-2.793342	0.0086
LFD	-0.508181	0.149051	-3.409442	0.0017
LENERGY	0.098769	0.737076	0.134001	0.8942
C	10.87557	7.968760	1.364776	0.1816

Table 89. Level Equation with Constant and Trend (for Tunisia)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.179438	0.179471	-0.999814	0.3247
LTRD	0.254264	0.053461	4.756057	0.0000
LFD	0.361538	0.147295	2.454517	0.0196
LENERGY	1.339682	0.204556	6.549213	0.0000
C	1.894118	3.048868	0.621253	0.5387

Table 90. Level Equation with Constant and Trend (for Turkey)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	3.572236	0.737037	4.846753	0.0000
LTRD	0.434284	0.098090	4.427406	0.0001
LFD	0.130303	0.084699	1.538419	0.1313
LENERGY	-0.987171	0.485854	-2.031825	0.0484
C	-68.76189	13.78825	-4.986991	0.0000

Table 91. Level Equation with Constant and Trend (for Venezuela)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.165591	0.206551	-0.801695	0.4285
LTRD	-0.010845	0.079720	-0.136041	0.8926
LFD	0.080863	0.038501	2.100317	0.0434
LENERGY	0.018393	0.167353	0.109906	0.9131
C	14.72112	5.439028	2.706572	0.0107

Table 92. Level Equation with Constant and Trend (for Zambia)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.185755	0.291041	-0.638245	0.5277
LTRD	1.056715	0.364253	2.901045	0.0066
LFD	0.134894	0.078815	1.711522	0.0964
LENERGY	1.233722	0.654737	1.884302	0.0684
C	-1.878696	5.053731	-0.371744	0.7125

Table 93. Level Equation with Constant and Trend (for Austria)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.265322	0.317975	-0.834410	0.4086
LTRD	0.119131	0.103257	1.153739	0.2548
LFD	0.077372	0.134699	0.574406	0.5686
LENERGY	1.164156	0.137929	8.440240	0.0000
C	5.577186	6.789428	0.821452	0.4158

Table 94. Level Equation with Constant and Trend (for Canada)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	5.120274	4.085976	1.253134	0.2169
LTRD	2.005282	1.319701	1.519497	0.1360
LFD	-0.275327	0.385454	-0.714293	0.4789
LENERGY	-1.626736	2.123355	-0.766116	0.4478
C	-109.0008	86.30066	-1.263035	0.2134

Table 95. Level Equation with Constant and Trend (for Cyprus)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.151493	0.095897	1.579750	0.1250
LTRD	-0.520190	0.110633	-4.701960	0.0001
LFD	0.423118	0.053091	7.969664	0.0000
LENERGY	0.122251	0.103300	1.183455	0.2462
C	6.540114	1.416705	4.616425	0.0001

Table 96. Level Equation with Constant and Trend (for Denmark)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.935433	0.819392	1.141618	0.2599
LTRD	0.034780	0.098805	0.352002	0.7266
LFD	-0.178414	0.040176	-4.440812	0.0001
LENERGY	0.683805	0.206076	3.318223	0.0019
C	-19.26289	18.52954	-1.039578	0.3043

Table 97. Level Equation with Constant and Trend (for Greece)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.476570	0.128907	-3.696991	0.0006
LTRD	0.099090	0.056696	1.747757	0.0875
LFD	0.108682	0.044811	2.425351	0.0195
LENERGY	0.898622	0.067450	13.32286	0.0000
C	13.79523	2.688916	5.130405	0.0000

Table 98. Level Equation with Constant and Trend (for Iceland)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	2.567101	2.043215	1.256403	0.2158
LTRD	-0.354563	1.143094	-0.310178	0.7579
LFD	-0.734577	0.594292	-1.236054	0.2231
LENERGY	-6.015397	4.118391	-1.460618	0.1514
C	-10.11093	30.83878	-0.327864	0.7446

Table 99. Level Equation with Constant and Trend (Italy)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	0.692498	0.110383	6.273613	0.0000
LTRD	-0.032934	0.033079	-0.995603	0.3253
LFD	0.127819	0.019562	6.534197	0.0000
LENERGY	0.746455	0.059156	12.61836	0.0000
C	-14.28518	2.468410	-5.787201	0.0000

Table 100. Level Equation with Constant and Trend (for Japan)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.568740	0.131630	-4.320745	0.0001
LTRD	0.186749	0.079817	2.339710	0.0240
LFD	-0.092766	0.213862	-0.433768	0.6666
LENERGY	1.615557	0.114913	14.05895	0.0000
C	8.821423	3.296925	2.675652	0.0105

Table 101. Level Equation with Constant and Trend (for Netherlands)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-3.736336	1.040335	-3.591474	0.0008
LTRD	-0.501676	0.225511	-2.224623	0.0314
LFD	-0.104198	0.082863	-1.257479	0.2154
LENERGY	2.224018	0.438330	5.073849	0.0000
C	85.35231	22.19112	3.846238	0.0004

Table 102. Level Equation with Constant and Trend (for Spain)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	2.003177	0.864315	2.317648	0.0252
LTRD	0.311192	0.152022	2.047011	0.0467
LFD	-0.132415	0.139852	-0.946818	0.3489
LENERGY	0.327216	0.337962	0.968203	0.3382
C	-44.53897	19.12004	-2.329439	0.0245

Table 103. Level Equation with Constant and Trend (for US)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP	-0.971223	0.380545	-2.552188	0.0143
LTRADE	-0.027996	0.070294	-0.398272	0.6924
LFD	-0.266504	0.096544	-2.760448	0.0085
LENERGY	1.006061	0.191215	5.261410	0.0000
C	28.69540	9.060501	3.167088	0.0028

Table 104. Level Equation Summary

COUNTRY	GDP	ENERGY	FD	TRD
DEVELOPING				
CHINA	NS	(+)	NS	NS
COLOMBIA	NS	(+)	(+)	(+)
GHANA	(+)	(+)	NS	NS
NIGERIA	NS	(+)	(-)	(-)
OMAN	NS	NS	NS	NS
SAUDI ARABIA	NS	(+)	NS	NS
SENEGAL	(-)	(+)	(-)	NS
TOGO	(-)	(+)	(+)	NS
TRINIDAD AND TOBAGO	NS	(-)	(-)	NS
TUNISIA	NS	(+)	(+)	(+)
TURKEY	(+)	(-)	NS	(+)
VENEZUELA	NS	NS	(+)	NS
ZMBIA	NS	(+)	(+)	(+)
DEVELOPED				
AUSTRIA	NS	(+)	NS	NS
CANADA	NS	NS	NS	NS
CYPRUS	NS	NS	(+)	(-)
DENMARK	NS	(+)	(-)	NS
GREECE	(-)	(+)	(+)	(+)
ICELAND	NS	NS	NS	NS
ITALY	(+)	(+)	(+)	NS
JAPAN	(-)	(+)	NS	(+)
NETHERLANDS	(-)	(+)	NS	(-)
SPAIN	(+)	NS	NS	(+)
US	(-)	(+)	(-)	NS

Table 105. Conditional Error Correction Models through the ARDL Approach (for developing countries)

Panel (a). China

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0,618	0,113	0,000
ΔlnCO2	0,377	0,150	0,021
ΔlnGDP	0,022	0,031	0,477
ΔlnFD	0,094	0,087	0,290
ΔlnENERGY	0,890	0,118	0,000
$\Delta lnENERGY_{t-1}$	0,507	0,137	0,001
Intercept	-0,011	0,018	0,531

Adj. R^2=0,906078, S.E.of Regr. = 0.017079, AIC = -5.077076, F-stat. = 30.54937, F-prob. = 0.0000, D-W stat. = 2.131124

Panel (b). Colombia

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0,974	0,124	0,000
ΔGDP	0,573	0,277	0,050
ΔGDP_{t-1}	-0,879	0,296	0,007
ΔlnTRD	-0,044	0,048	0,366
ΔlnFD	0,362	0,049	0,000
ΔlnENERGY	0,352	0,164	0,042
$\Delta lnENERGY_{t-1}$	-0,986	0,196	0,000
Intercept	-0,004	0,011	0,678

Adj. R^2= 0.764223, S.E. of Regr. = 0.027213 , AIC = -4.157907, F-stat. = 12.41053, F-prob. = 0.00000, D-W stat. = 2.733056

Table 105. Conditional Error Correction Models through the ARDL Approach (for developing countries continued)

Panel (a). Ghana

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0,218	0,052	0,000
$\Delta lnCO2_{t-1}$	-0,480	0,098	0,000
$\Delta lnGDP$	0,369	0,338	0,285
$\Delta lnTRD$	-0,097	0,071	0,180
$\Delta lnFD$	-0,341	0,099	0,002
$\Delta lnENERGY$	0,984	0,292	0,002
$\Delta lnENERGY_{t-1}$	1,029	0,278	0,001
Intercept	-0,018	0,018	0,348

Adj. R^2= 0.752744 , S.E. of Regr. = 0.061286,
AIC = -2.539311,
F-stat. = 14.91742, F-prob. = 0.000000,
D-W stat. = 2.133082

Panel (b). Nigeria

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0,824	0,083	0,000
$\Delta lnGDP$	-0,380	0,363	0,318
$\Delta lnGDP_{t-1}$	-1,319	0,386	0,005
$\Delta lnGDP_{t-2}$	-0,292	0,272	0,306
$\Delta lnGDP_{t-3}$	0,388	0,337	0,274
$\Delta lnGDP_{t-4}$	1,643	0,447	0,003
$\Delta lnTRD$	-0,126	0,108	0,267
$\Delta lnTRD_{t-1}$	1,611	0,193	0,000
$\Delta lnTRD_{t-2}$	0,455	0,127	0,004
$\Delta lnTRD_{t-3}$	-0,062	0,134	0,652
$\Delta lnTRS_{t-4}$	-0,198	0,086	0,042
$\Delta lnFD$	0,013	0,080	0,870
$\Delta lnFD_{t-1}$	0,921	0,131	0,000
$\Delta lnFD_{t-2}$	0,840	0,095	0,000
$\Delta lnFD_{t-3}$	0,636	0,104	0,000
$\Delta lnFD_{t-4}$	0,638	0,092	0,000
$\Delta lnENERGY$	7,570	0,841	0,000
$\Delta lnENERGY_{t-1}$	1,841	0,793	0,040
$\Delta lnENERGY_{t-2}$	-0,124	0,871	0,888
$\Delta lnENERGY_{t-3}$	3,293	0,752	0,001
$\Delta lnENERGY_{t-4}$	1,880	0,939	0,070
Intercept	-0,152	0,059	0,027

Adj. R^2= 0.913781, S.E. of Regr. = 0.970362 ,
AIC = -2.629595,
F-stat. = 17.14986, F-prob. = 0.000012 ,
D-W stat. = 3.209871

Table 105. Conditional Error Correction Models through the ARDL Approach (for developing countries continued)

Panel (a). Oman

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.184	0.014	0.000
$\Delta lnCO2_{t-1}$	-0.594	0.085	0.000
$\Delta lnCO2_{t-2}$	-0.067	0.026	0.025
$\Delta lnCO2_{t-3}$	-0.245	0.032	0.000
ΔlnGDP	0.414	0.130	0.008
$\Delta lnGDP_{t-1}$	2.825	0.304	0.000
$\Delta lnGDP_{t-2}$	2.710	0.216	0.000
$\Delta lnGDP_{t-3}$	1.322	0.226	0.000
ΔlnTRD	-0.953	0.096	0.000
$\Delta lnTRD_{t-1}$	1.406	0.140	0.000
$\Delta lnTRD_{t-2}$	1.424	0.131	0.000
$\Delta lnTRD_{t-3}$	0.615	0.110	0.000
ΔlnFD	0.294	0.056	0.000
$\Delta lnFD_{t-1}$	-0.281	0.057	0.000
$\Delta lnFD_{t-2}$	0.320	0.046	0.000
$\Delta lnFD_{t-3}$	0.085	0.046	0.094
ΔlnENERGY	-0.221	0.029	0.000
$\Delta lnENERGY_{t-1}$	-0.196	0.035	0.000
$\Delta lnENERGY_{t-2}$	0.120	0.031	0.003
$\Delta lnENERGY_{t-3}$	0.083	0.031	0.023
Intercept	0.156	0.011	0.000

Adj. R^2= 0.958811, S.E. of Regr. = 0.985385,
AIC = -4.580359,
F-stat. = 37.08182, F-prob. = 0.00000,
D-W stat. = 2.451708

Panel (b). Saudi Arabia

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.736	0.210	0.002
$\Delta lnCO2_{t-1}$	0.339	0.180	
$\Delta lnCO2_{t-2}$	0.359	0.187	0.068
ΔlnGDP	0.612	0.188	0.003
ΔlnTRD	0.191	0.203	0.358
ΔlnFD	0.015	0.027	0.581
ΔlnENERGY	0.407	0.164	0.022
Intercept	-0.009	0.023	0.684

Adj. R^2= 0.474905 , S.E. of Regr. =0.606179,
AIC = -1.777397,
F-stat. = 4.617675, F-prob. = 0.002924,
D-W stat. = 2.362267

Table 105. Conditional Error Correction Models through the ARDL Approach (for developing countries continued)

Panel (a). Senegal *Panel (b). Togo*

Regressor	Coefficient	Standard Error	p-value	Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0,772	0,127	0,000	$\hat{u}_{t-1}$	-3,837	0,258	0,000
ΔlnGDP	-0,590	0,453	0,203	$\Delta lnCO2_{t-1}$	1,924	0,181	0,000
ΔlnTRD	-9.05E	0,121	0,999	$\Delta lnCO2_{t-2}$	1,352	0,134	0,000
$\Delta lnTRD_{t-1}$	0,508	0,118	0,000	$\Delta lnCO2_{t-3}$	0,686	0,079	0,000
ΔlnFD	-0,038	0,212	0,861	ΔlnGDP	-0,993	0,328	0,011
$\Delta lnFD_{t-1}$	0,594	0,207	0,008	$\Delta lnGDP_{t-1}$	3,247	0,420	0,000
ΔlnENERGY	0,499	0,483	0,310	$\Delta lnGDP_{t-2}$	3,189	0,501	0,000
Intercept	0,026	0,022	0,256	$\Delta lnGDP_{t-3}$	0,683	0,299	0,043
				$\Delta lnGDP_{t-4}$	0,455	0,260	0,108
				ΔlnTRD	-1,727	0,215	0,000
				$\Delta lnTRD_{t-1}$	-0,663	0,159	0,001
				$\Delta lnTRD_{t-2}$	-0,898	0,137	0,000
				$\Delta lnTRD_{t-3}$	-0,557	0,119	0,000
				ΔlnFD	0,385	0,202	0,083
				$\Delta lnFD_{t-1}$	-4,154	0,313	0,000
				$\Delta lnFD_{t-2}$	-2,649	0,271	0,000
				$\Delta lnFD_{t-3}$	-1,586	0,207	0,000
				$\Delta lnFD_{t-4}$	-0,730	0,157	0,000
				ΔlnENERGY	2,981	0,462	0,000
				$\Delta lnENERGY_{t-1}$	-14,682	1,330	0,000
				$\Delta lnENERGY_{t-2}$	-10,824	1,074	0,000
				$\Delta lnENERGY_{t-3}$	-6,347	0,659	0,000
				Intercept	-0,662	0,060	0,000

Panel (a) Senegal: Adj. R^2= 0.630798 , S.E. of Regr. = 0.88690,
AIC = -1.818518,
F-stat. = 9.786802, F-prob. =0.000000 ,
D-W stat. = 2.194434

Panel (b) Togo: Adj. R^2= 0.965698, S.E. of Regr. = 0.988566,
AIC = -2.731278,
F-stat. = 43.22950, F-prob. = 0.00000,
D-W stat. = 2.858660

Table 105. Conditional Error Correction Models through the ARDL Approach (for developing countries continued)

Panel (a). Trinidad and Tobago

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.986	0.148	0.000
ΔlnGDP	0.116	0.352	0.744
ΔlnTRD	-0.595	0.195	0.005
ΔlnFD	-0.222	0.105	0.044
$\Delta lnFD_{t-1}$	0.427	0.140	0.005
ΔlnENERGY	0.042	0.207	0.841
Intercept	0.048	0.018	0.013

Adj. R^2= 0.573820 , S.E. of Regr. =0.084344, AIC = -1.939170, F-stat. = 9.078567, F-prob. = 0.000011, D-W stat. = 1.719713

Panel (b). Tunusia

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-5.696	1.007	0.000
$\Delta lnCO2_{t-1}$	3.497	0.785	0.002
$\Delta lnCO2_{t-2}$	2.595	0.565	0.001
$\Delta lnCO2_{t-3}$	1.584	0.410	0.004
$\Delta lnCO2_{t-4}$	0.597	0.254	0.046
ΔlnGDP	1.517	0.516	0.018
$\Delta lnGDP_{t-1}$	3.026	0.954	0.013
$\Delta lnGDP_{t-2}$	2.729	0.561	0.001
$\Delta lnGDP_{t-3}$	0.219	0.348	0.545
$\Delta lnGDP_{t-4}$	0.782	0.298	0.030
ΔlnTRD	0.511	0.118	0.002
$\Delta lnTRD_{t-1}$	-0.951	0.205	0.001
$\Delta lnTRD_{t-2}$	-0.454	0.125	0.006
$\Delta lnTRD_{t-3}$	-0.334	0.130	0.033
$\Delta lnTRS_{t-4}$	-0.177	0.127	0.201
ΔlnFD	0.737	0.226	0.011
$\Delta lnFD_{t-1}$	-0.785	0.197	0.004
$\Delta lnFD_{t-2}$	-0.311	0.174	0.111
$\Delta lnFD_{t-3}$	-0.432	0.157	0.025
ΔlnENERGY	0.579	0.278	0.070
$\Delta lnENERGY_{t-1}$	-6.176	1.372	0.002
$\Delta lnENERGY_{t-2}$	-5.430	1.184	0.001
$\Delta lnENERGY_{t-3}$	-3.002	0.766	0.004
$\Delta lnENERGY_{t-4}$	-1.004	0.292	0.008
Intercept	-0.079	0.032	0.040

Adj. R^2= 0.799830 , S.E. of Regr. = 0.949957, AIC = -4.483352, F-stat. = 6.327656, F-prob. = 0.005484, D-W stat. = 2.628580

Table 105. Conditional Error Correction Models through the ARDL Approach (for developing countries continued)

Panel (a). Turkey *Panel (b). Venezuela*

Regressor	Coefficient	Standard Error	p-value	Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0,613	0,071	0,000	$\hat{u}_{t-1}$	-0,814	0,189	0,000
$\Delta lnCO2_{t-1}$	-0,159	0,093	0,104	ΔlnGDP	-0,865	0,273	0,004
ΔlnGDP	0,588	0,103	0,000	ΔlnTRD	-0,118	0,106	0,274
$\Delta lnGDP_{t-1}$	-1,237	0,189	0,000	ΔlnFD	-0,064	0,119	0,596
$\Delta lnGDP_{t-2}$	-0,899	0,135	0,000	ΔlnENERGY	0,162	0,206	0,436
$\Delta lnGDP_{t-3}$	-0,305	0,120	0,020	Intercept	0,036	0,014	0,019
ΔlnTRD	0,032	0,019	0,106				
$\Delta lnTRD_{t-1}$	-0,133	0,026	0,000				
$\Delta lnTRD_{t-2}$	-0,028	0,018	0,138				
$\Delta lnTRD_{t-3}$	0,028	0,018	0,132				
$\Delta lnTRS_{t-4}$	0,004	0,016	0,800				
$\Delta lnTRD_{t-5}$	0,044	0,015	0,007				
ΔlnFD	-0,101	0,027	0,001				
$\Delta lnFD_{t-1}$	-0,170	0,029	0,000				
$\Delta lnFD_{t-2}$	-0,087	0,030	0,009				
$\Delta lnFD_{t-3}$	-0,203	0,035	0,000				
$\Delta lnFD_{t-4}$	0,005	0,029	0,865				
$\Delta lnFD_{t-5}$	-0,105	0,030	0,003				
ΔlnENERGY	0,630	0,111	0,000				
$\Delta lnENERGY_{t-1}$	0,205	0,141	0,162				
$\Delta lnENERGY_{t-2}$	0,003	0,089	0,969				
$\Delta lnENERGY_{t-3}$	-0,529	0,093	0,000				
Intercept	-0,047	0,008	0,000				

Turkey: Adj. R^2= 0,950460 , S.E. of Regr. = 0.977042, AICRAIC = -5.764603, F-stat. = 36.75517, F-prob. = 0.00000, D-W stat. = 2.546330

Venezuela: Adj. R^2= 0.336224, S.E. of Regr. = 0.073781 , AIC = -2.228025 , F-stat. = 4.647040 , F-prob. = 0.000035, D-W stat. = 1.917117

Table 105. Conditional Error Correction Models through the ARDL Approach (for developing countries continued)

Panel (a). Zambia *Panel (b).*

Regressor	Coefficient	Standard Error	p-value	Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.894	0.161	0.000				
ΔlnGDP	-0.092	0.349	0.794				
$\Delta lnGDP_{t-1}$	0.847	0.307	0.010				
$\Delta lnGDP_{t-2}$	0.651	0.332	0.061				
ΔlnTRD	0.015	0.106	0.893				
$\Delta lnTRD_{t-1}$	-0.253	0.136	0.073				
ΔlnFD	-0.035	0.047	0.462				
$\Delta lnFD_{t-1}$	-0.065	0.046	0.172				
ΔlnENERGY	1.330	0.475	0.009				
Intercept	-0.047	0.015	0.003				

Adj. R^2= 0.668403, S.E. of Regr. = 0.751302,
AIC = -2.568318,
F-stat. = 9.062828, F-prob. = 0.000004 ,
D-W stat. = 2.133306

Table 106. Conditional Error Correction Models through the ARDL Approach (for developed countries)

Panel (a). Austria

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.876	0.137	0.000
ΔlnGDP	0.692	0.318	0.000
$\Delta lnGDP_{t-1}$	0.052	0.283	0.855
$\Delta lnGDP_{t-2}$	0.625	0.271	0.028
$\Delta lnGDP_{t-3}$	-0.324	0.315	0.311
$\Delta lnGDP_{t-4}$	0.637	0.267	0.023
$\Delta lnGDP_{t-5}$	1.148	0.296	0.000
ΔlnTRD	-0.283	0.112	0.016
ΔlnFD	0.022	0.157	0.885
ΔlnENERGY	1.189	0.128	0.000
Intercept	-0.005	0.012	0.649

Panel (b). Canada

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.348	0.034	0.000
$\Delta lnCO2_{t-1}$	-0.744	0.121	0.000
$\Delta lnCO2_{t-2}$	-0.085	0.105	0.427
$\Delta lnCO2_{t-3}$	0.359	0.089	0.001
ΔlnGDP	-0.903	0.168	0.000
$\Delta lnGDP_{t-1}$	-2.992	0.367	0.000
$\Delta lnGDP_{t-2}$	-1.840	0.348	0.000
$\Delta lnGDP_{t-3}$	-0.343	0.208	0.120
$\Delta lnGDP_{t-4}$	-0.707	0.237	0.009
$\Delta lnGDP_{t-5}$	-0.753	0.179	0.000
ΔlnTRD	0.083	0.089	0.361
$\Delta lnTRD_{t-1}$	-0.291	0.081	0.002
$\Delta lnTRD_{t-2}$	-0.334	0.071	0.000
$\Delta lnTRD_{t-1}$	-0.515	0.088	0.000
ΔlnFD	-0.032	0.031	0.308
$\Delta lnFD_{t-1}$	-0.050	0.028	0.095
$\Delta lnFD_{t-2}$	-0.194	0.033	0.000
$\Delta lnFD_{t-3}$	-0.150	0.030	0.000
$\Delta lnFD_{t-4}$	-0.060	0.036	0.119
$\Delta lnFD_{t-5}$	-0.025	0.031	0.424
ΔlnENERGY	1.287	0.105	0.000
$\Delta lnENERGY_{t-1}$	2.212	0.249	0.000
$\Delta lnENERGY_{t-2}$	1.048	0.246	0.000
$\Delta lnENERGY_{t-3}$	0.216	0.188	0.268

Table 106. Conditional Error Correction Models through the ARDL Approach (for developed countries)

Panel (a). Austria *Panel (b). Canada*

Regressor	Coefficient	Standard Error	p-value	Regressor	Coefficient	Standard Error	p-value
				ΔlnENERGY$_{t-4}$	1.095	0.156	0.000
				ΔlnENERGY$_{t-5}$	0.563	0.158	0.002
				Intercept	-0.045	0.011	0.001

Panel (a). Austria: Adj. R^2= 0.970062 , S.E. of Regr. = 0.840048, AIC = -4.196001, F-stat. = 101.2140, F-prob. = 0.00000, D-W stat. = 2.180262

Panel (b). Canada: Adj. R^2= 0.910405, S.E. of Regr. = 0.967221 , AIC = -5.874999, F-stat. = 17.02363, F-prob. = 0.00000, D-W stat. = 2.681356

Table 106. Conditional Error Correction Models through the ARDL Approach (for developed countries continued)

Panel (a). Cyprus *Panel (b). Denmark*

Regressor	Coefficient	Standard Error	p-value	Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0,693	0,135	0,000	$\hat{u}_{t-1}$	-0,960	0,160	0,000
ΔlnGDP	0,124	0,183	0,506	ΔlnGDP	-0,583	0,228	0,015
ΔlnTRD	-0,145	0,083	0,093	ΔlnGDP$_{t-1}$	-0,602	0,231	0,013
ΔlnFD	0,040	0,069	0,560	ΔlnTRD	-0,060	0,096	0,532
ΔlnENERGY	0,591	0,082	0,000	ΔlnFD	-0,118	0,056	0,041
Intercept	0,007	0,011	0,543	ΔlnENERGY	1,458	0,084	0,000
				ΔlnENERGY$_{t-1}$	0,205	0,100	0,047
				Intercept	0,005	0,009	0,605

Panel (a). Cyprus: Adj. R^2= 0.796424, S.E. of Regr. = 0.025242, AIC = -4.357680, F-stat. = 26.03795, F-prob. = 0.000000, D-W stat. = 2.061336

Panel (b). Denmark: Adj. R^2= 0.913587, S.E. of Regr. = 0.027395, AIC = -4.203064, F-stat. = 70.47495, F-prob. = 0.000000, D-W stat. = 2.013648

Table 106. Conditional Error Correction Models through the ARDL Approach (for developed countries continued)

Panel (a). Greece

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.961	0.122	0.000
$\Delta lnGDP$	0.221	0.193	0.260
$\Delta lnGDP_{t-1}$	0.223	0.227	0.334
$\Delta lnGDP_{t-2}$	-0.373	0.165	0.030
$\Delta lnGDP_{t-3}$	-0.452	0.156	0.006
$\Delta lnGDP_{t-4}$	0.244	0.157	0.130
$\Delta lnTRD$	0.147	0.072	0.049
$\Delta lnFD$	0.152	0.055	0.009
$\Delta lnENERGY$	0.465	0.129	0.001
$\Delta lnENERGY_{t-1}$	-0.287	0.145	0.056
Intercept	0.005	0.008	0.501

Adj. R^2= 0.784991, S.E. of Regr. = 0.834993,
AIC = -4.026210,
F-stat. = 16.69912 , F-prob. = 0.000000,
D-W stat. = 2.065858

Panel (b). Iceland

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.365	0.029	0.000
$\Delta lnCO2_{t-1}$	-0.298	0.075	0.001
$\Delta lnCO2_{t-2}$	-0.814	0.084	0.000
$\Delta lnCO2_{t-3}$	-0.678	0.058	0.000
$\Delta lnCO2_{t-4}$	-0.786	0.086	0.000
$\Delta lnCO2_{t-5}$	-0.564	0.071	0.000
$\Delta lnGDP$	1.880	0.147	0.000
$\Delta lnGDP_{t-1}$	-0.648	0.179	0.003
$\Delta lnGDP_{t-2}$	2.365	0.210	0.000
$\Delta lnGDP_{t-3}$	0.249	0.214	0.267
$\Delta lnGDP_{t-4}$	2.120	0.191	0.000
$\Delta lnTRD$	-0.184	0.058	0.007
$\Delta lnTRD_{t-1}$	-0.091	0.088	0.320
$\Delta lnTRD_{t-2}$	-0.722	0.083	0.000
$\Delta lnTRD_{t-3}$	-0.276	0.071	0.002
$\Delta lnTRD_{t-4}$	-0.832	0.079	0.000
$\Delta lnTRD_{t-5}$	-0.374	0.071	0.000
$\Delta lnFD$	-0.298	0.039	0.000
$\Delta lnFD_{t-1}$	0.097	0.047	0.063
$\Delta lnFD_{t-2}$	0.056	0.048	0.264
$\Delta lnFD_{t-3}$	0.629	0.065	0.000
$\Delta lnFD_{t-4}$	0.431	0.052	0.000
$\Delta lnFD_{t-5}$	0.724	0.047	0.000
$\Delta lnENERGY$	0.016	0.106	0.882
$\Delta lnENERGY_{t-1}$	0.958	0.136	0.000
$\Delta lnENERGY_{t-2}$	0.615	0.141	0.000
$\Delta lnENERGY_{t-3}$	0.010	0.130	0.938
$\Delta lnENERGY_{t-4}$	0.451	0.107	0.001
Intercept	0.066	0.011	0.000

Adj. R^2= 0.970032 , S.E. of Regr. = 0.009498,
AIC = -5.631469,
F-stat. = 48.39813, F-prob. = 0.000000 ,
D-W stat. = 2.609541

Table 106. Conditional Error Correction Models through the ARDL Approach (for developed countries continued)

Panel (a). Italy

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.637	0.102	0.000
ΔlnGDP	0.254	0.154	0.107
$\Delta lnGDP_{t-1}$	-0.318	0.118	0.010
ΔlnTRD	0.017	0.035	0.626
ΔlnFD	-0.001	0.045	0.976
ΔlnENERGY	0.623	0.076	0.000
Intercept	-0.009	0.004	0.028

Adj. R^2= 0.900075, S.E. of Regr. = 0.012805, AIC = -5.735849, F-stat. = 67.05480, F-prob. = 0.000000 , D-W stat. = 1.939954

Panel (b). Japan

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.700	0.094	0.000
ΔlnGDP	0.020	0.080	0.803
$\Delta lnGDP_{t-1}$	0.107	0.094	0.268
$\Delta lnGDP_{t-2}$	0.234	0.101	0.033
$\Delta lnGDP_{t-3}$	0.268	0.111	0.028
$\Delta lnGDP_{t-4}$	0.534	0.111	0.000
ΔlnTRD	0.002	0.022	0.923
$\Delta lnTRD_{t-1}$	-0.143	0.033	0.000
$\Delta lnTRD_{t-2}$	-0.148	0.023	0.000
$\Delta lnTRD_{t-3}$	-0.112	0.025	0.000
$\Delta lnTRD_{t-4}$	-0.045	0.026	0.104
$\Delta lnTRD_{t-5}$	-0.094	0.022	0.000
ΔlnFD	0.093	0.059	0.137
$\Delta lnFD_{t-1}$	-0.311	0.074	0.000
$\Delta lnFD_{t-2}$	0.151	0.071	0.049
$\Delta lnFD_{t-3}$	0.001	0.062	0.978
$\Delta lnFD_{t-4}$	0.029	0.054	0.593
$\Delta lnFD_{t-5}$	-0.057	0.043	0.211
ΔlnENERGY	1.241	0.070	0.000
$\Delta lnENERGY_{t-1}$	-0.238	0.064	0.001
$\Delta lnENERGY_{t-2}$	-0.166	0.087	0.072
$\Delta lnENERGY_{t-3}$	-0.179	0.090	0.065
$\Delta lnENERGY_{t-4}$	0.023	0.069	0.735
$\Delta lnENERGY_{t-5}$	0.118	0.047	0.023
Intercept	0.001	0.003	0.700

Adj. R^2= 0.978278 , S.E. of Regr. = 0.990993, AIC = -6.480093, F-stat. = 77.93597, F-prob. = 0.000000, D-W stat. = 2.471322

Table 106. Conditional Error Correction Models through the ARDL Approach (for developed countries continued)

Panel (a). Netherlands

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.950	0.092	0.000
$\Delta lnCO2_{t-1}$	0.069	0.069	0.335
$\Delta lnCO2_{t-2}$	0.005	0.083	0.948
$\Delta lnCO2_{t-3}$	-0.598	0.093	0.000
$\Delta lnCO2_{t-4}$	-0.285	0.077	0.002
ΔlnGDP	-0.190	0.263	0.482
$\Delta lnGDP_{t-1}$	1.730	0.296	0.000
$\Delta lnGDP_{t-2}$	2.512	0.388	0.000
$\Delta lnGDP_{t-3}$	1.990	0.227	0.000
$\Delta lnGDP_{t-4}$	0.345	0.221	0.143
ΔlnTRD	0.290	0.064	0.000
$\Delta lnTRD_{t-1}$	0.331	0.078	0.001
$\Delta lnTRD_{t-2}$	0.089	0.053	0.116
$\Delta lnTRD_{t-3}$	-0.102	0.058	0.100
$\Delta lnTRD_{t-4}$	0.197	0.056	0.004
$\Delta lnTRD_{t-5}$	-0.222	0.060	0.002
ΔlnFD	0.137	0.045	0.009
$\Delta lnFD_{t-1}$	0.171	0.047	0.003
$\Delta lnFD_{t-2}$	0.662	0.059	0.000
$\Delta lnFD_{t-3}$	0.521	0.084	0.000
$\Delta lnFD_{t-4}$	0.221	0.065	0.005
$\Delta lnFD_{t-5}$	0.396	0.065	0.000
ΔlnENERGY	1.130	0.067	0.000
$\Delta lnENERGY_{t-1}$	-0.796	0.149	0.000
$\Delta lnENERGY_{t-2}$	-0.696	0.163	0.000
$\Delta lnENERGY_{t-3}$	0.384	0.101	0.002
$\Delta lnENERGY_{t-4}$	-0.169	0.104	0.128
$\Delta lnENERGY_{t-5}$	0.296	0.055	0.00
Intercept	0.079	0.009	0.000

Adj. R^2= 0.976378 , S.E. of Regr. = 0.992510,
AIC = -6.186592, SBC = -4.986772,
F-stat. = 61.52458, F-prob. = 0.000000 ,
D-W stat. = 2.933601

Panel (b). Spain

Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.704	0.128	0.000
$\Delta lnCO2_{t-1}$	-0.112	0.133	0.410
$\Delta lnCO2_{t-2}$	0.185	0.119	0.132
ΔlnGDP	-0.281	0.303	0.364
$\Delta lnGDP_{t-1}$	-0.721	0.319	0.033
$\Delta lnGDP_{t-2}$	-1.500	0.372	0.000
ΔlnTRD	0.156	0.063	0.021
$\Delta lnTRD_{t-1}$	-0.099	0.063	0.130
$\Delta lnTRD_{t-2}$	0.214	0.059	0.001
$\Delta lnTRD_{t-3}$	-0.027	0.063	0.671
$\Delta lnTRD_{t-4}$	-0.241	0.065	0.001
ΔlnFD	0.232	0.080	0.007
ΔlnENERGY	1.137	0.136	0.000
$\Delta lnENERGY_{t-1}$	0.197	0.151	0.204
$\Delta lnENERGY_{t-2}$	-0.072	0.148	0.629
$\Delta lnENERGY_{t-3}$	-0.145	0.121	0.241
$\Delta lnENERGY_{t-4}$	0.334	0.108	0.005
$\Delta lnENERGY_{t-5}$	-0.305	0.108	0.009
Intercept	-0.035	0.010	0.002

Adj. R^2= 0.886266 , S.E. of Regr. = 0.935009,
AIC = -4.806941, SBC = -4.028737,
F-stat. = 19.18242, F-prob. = 0.000000,
D-W stat. = 2.182560

Table 106. Conditional Error Correction Models through the ARDL Approach (for developed countries continued)

Panel (a). US *Panel (b).*

Regressor	Coefficient	Standard Error	p-value	Regressor	Coefficient	Standard Error	p-value
$\hat{u}_{t-1}$	-0.629	0.081	0.000				
$\Delta lnCO2_{t-1}$	-0.250	0.106	0.026				
$\Delta lnCO2_{t-2}$	-0.346	0.103	0.002				
$\Delta lnGDP$	-0.169	0.111	0.140				
$\Delta lnGDP_{t-1}$	-0.108	0.105	0.312				
$\Delta lnGDP_{t-2}$	-0.224	0.110	0.053				
$\Delta lnGDP_{t-3}$	-0.356	0.105	0.002				
$\Delta lnGDP_{t-4}$	0.242	0.087	0.010				
$\Delta lnTRD$	0.116	0.031	0.001				
$\Delta lnFD$	0.094	0.048	0.062				
$\Delta lnFD_{t-1}$	0.099	0.056	0.091				
$\Delta lnFD_{t-2}$	0.299	0.061	0.000				
$\Delta lnFD_{t-3}$	0.100	0.069	0.159				
$\Delta lnFD_{t-4}$	0.068	0.056	0.240				
$\Delta lnENERGY$	0.841	0.083	0.000				
$\Delta lnENERGY_{t-1}$	0.386	0.140	0.010				
$\Delta lnENERGY_{t-2}$	0.910	0.143	0.000				
$\Delta lnENERGY_{t-3}$	0.413	0.102	0.000				
Intercept	0.019	0.006	0.006				

Adj. R^2= 0.940258 , S.E. of Regr. =0.965861,
AIC = -6.733460,
F-stat. = 37.72319, F-prob. = 0.000000,
D-W stat. = 2.744584