Does Globalization Affect Energy Consumption in Turkey? Its Implication on Environmental Quality

Owotomiwa Christiana Olubamiro

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Assoc. Prof. Dr. Ali Hakan Ulusoy
Acting Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Arts in Economics.

Prof. Dr. Mehmet Balcılar
Chair, Department of Economics

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Arts in Economics.

Assoc. Prof. Dr. Hasan Güngör
Supervisor

Examining Committee

1. Assoc. Prof. Dr. Çağay Coşkuner _____

2. Assoc. Prof. Dr. Hasan Güngör _____

3. Asst. Prof. Dr. Demet Beton Kalmaz _____

ABSTRACT

This study employs time series econometrics techniques to examine the direction of causality relationship between globalization, carbon emissions, energy consumption and economic growth in the case of Turkey. The objective of this research is to examine whether causality relationship exist between globalization and energy consumption for Turkey. In order to control for omission variable bias, we employ real GDP per capita and carbon dioxide emissions as some additional variables to proxy for economic growth and environmental quality over the periods of 1980-2014.

In order to achieve research objective, we conduct Granger causality test. Empirical results show bidirectional causality between CO_2 emissions and globalization and between energy consumption and globalization. In addition, results also show the presence of a unidirectional causality relationship running from energy consumption to CO_2 emissions and from globalization to economic growth. Lastly, we find neutrality hypothesis between CO_2 emissions and economic growth and between energy consumption and economic growth.

Based on the results, we are of the opinion that the bidirectional causality relationship established between globalization and energy consumption would have grievous impact on the environmental quality, as increase in energy demand through the channel of globalition via international trade would increase carbon emissions level in Turkey. In addition, results also show that environmental pollution in the sampled country are not output driven. Thus, energy conservation policies would not

hurt or retard economic performance and hence, economic growth of Turkey. Globalization and energy consumption appears to influence environmental pollution in the case of Turkey.

Keywords: Energy consumption, Globalization, Carbon dioxide emissions, Economic growth, Turkey,

ÖZ

Bu çalışmada küreselleşme, karbon emisyonları, enerji tüketimi ve durumunda Türkiye'nin ekonomik büyüme arasında nedensellik ilişkisinin yönünü incelemek için zaman serisi Ekonometri teknikleri kullanır. Bu araştırmanın amacı incelemektir küreselleşme ve Türkiye için enerji tüketimi arasındaki nedensellik ilişkisi var olup olmadığını. İhmal değişken önyargı için kontrol etmek için biz gerçek kişi başına GSYİH ve karbon dioksit emisyonları ekonomik büyüme ve çevre kalitesi için proxy için ek bir değişkenler olarak 1980-2014 dönemi üzerinde istihdam.

Araştırma amacı gerçekleştirmek için Granger nedensellik testi yapmak. Ampirik sonuçlar çift yönlü nedensellik ve enerji tüketimi ve küreselleşme CO2 emisyonları ve küreselleşme arasında gösterir. Ayrıca, sonuçlar da enerji tüketimi CO2 emisyonları ve küreselleşme ekonomik büyüme için çalışan bir tek yönlü nedensellik ilişkisi olup olmadığını gösterir. Son olarak, biz tarafsızlık hipotez CO2 emisyonları ve ekonomik büyüme arasında ve enerji tüketimi ve ekonomik büyüme arasında bulabilirsiniz.

Sonuçlarına göre küreselleşme ve enerji tüketimi arasında çift yönlü nedensellik ilişkisi artış enerji talebinin kanalı aracılığıyla olarak çevre kalitesine büyük etkisi olurdu fikir olduğu globalition uluslararası ticaret yoluyla karbon emisyon seviyesi Türkiye'deki artış olacaktır. Ayrıca, sonuçlar da tahrik çıkış örneklenen ülkenin çevre kirliliği değildir gösterir. Böylece, enerji koruma politikaları değil zarar vereceğini ya da geri zekalı ekonomik performans ve dolayısıyla, Türkiye'nin ekonomik

büyüme. Küreselleşme ve enerji tüketimi durumunda Türkiye'de çevre kirliliği etkilemek için görünür.

Anahtar Kelimeler: Enerji tüketimi, Küreselleşme, Karbon dioksit emisyonları, Ekonomik, Türkiye,

DEDICATION

To my beloved and precious mother (Mrs. Mojiosla Olubamiro)

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LIST OF ABBREVIATIONS

ADF	Augment Dickey Fuller
BC –LSDV	Bias-Corrected Least Square Dummy Variable
CO2	Carbon dioxide emissions
D F	Dickey and Fuller
EC	Energy Consumption
ECM	Error Correction Model
GDP	Gross Domestic Product
GLOB	Globalization
KPSS	Kwiatkowski Phillip Schmidt and Schin
RGDP	Real Gross Domestic Product
V A R	Vector Auto Regression
W D I	World Bank Development Indicators

Chapter 1

INTRODUCTION

1.1 Background to the Study

Globalization was hardly debated over 20 years ago. At this period, Marber (2005) argued that people (less than 15 percent of the world population) were hardly involved in veritable international trade all over the globe. In addition, most of the third world countries at this period were used as tools in the world chess game of the West while the probability of Communist China merging economically with the West seems unrealistic and doubtful. The possibility of the developing and less developing economies attaining significant and sound economic, cultural, political and socio-cultural progress couple with the Western standard of living seems unattainable Marber (2005).

Over the years, countries of the world have integrated into one another and the world is now a global village. This is facilitated by economic, political and social interaction between one country and the other, either through bilateral or unilateral trade. Over decades ago, some of the developed countries were somehow self-sufficient, however, the situation has changed tremendously as nations are now more interconnected and/or integrated, either through economic integration, political integration, or socio-cultural integration.

In this recent time, globalization has become one of the most significant economic, political and social-cultural forces economies of the world is using to restructure nations towards a rapid economic growth and development, to the extent that, economies of the world is currently experiencing a significant swift from a disintegrated and feeble world economy to a strong and sound integrated world economy due to the influence of globalization. In addition, increases experience in foreign trade, financial capital inflows, foreign direct investment, and technological transfer as a result of globalization, now exerts a significant impact on economic activities that may have positively or negatively influence economic performances all over the world.

We observed that while a lot of studies have been carried out on the relationships between and/or impacts of globalization on education, culture, employment, politics, technology, tourism, labor migration, social relations among others (see Gaburro and O'Boyle, 2003; Szeman, 2003 Berger, 2002; Keohane, 2002; Laidi and Costopolous, 2002; Smith and Baylis, 2001; Langhome, 2001; Gilpin, 2001; Beck, 2000; Friedman, 1999; Featherstone, 1995; Dicken, 1992; Robertson, 1992), not enough studies (see Shahbaz, Shahzad, Mahalik and Sadorsky, 2017; Overland, 2016; Shahbaz, Mallick, Mahalik and Loganathan, 2015) have been documented or reported in energy literature on other fascinating topics such as examination of the role or dynamic causality relationship between energy consumption and globalization. This reason among others motivates us to examine whether globalization has the predictive power over energy consumption and vice versa, using Turkey as a case study.

The choice of country is based on the fact that Turkish energy consumption has grown considerably since the beginning of the 1980s. Energy consumption is high given its transformation from agricultural to industrial enhanced by urbanization, especially after 1982. Turkey's energy import dependency, mainly on oil and natural gas is increasing due to the growing energy demand as Turkey gets globalized through trade. Thus, one would be theoretically right to assume that the increase in energy consumption over the years in this economy is due to globalization. In addition, globalization has been argued to positively related to trade liberation/openness of an economy. The more an industrial economy such as Turkey open to trade and foreign direct investment, the more increase in import, thus, increase in energy demand/consumption. As the level of energy demand increases, there is attendant economic growth. However, increase in the level of energy consumption would indicate increase in the level of carbon dioxide emissions. Therefore, increase in energy consumption as a result of globalization through foreign direct investment, trade and capital flight appears to have grievous impact on environmental quality (Shahbaz et al., 2018)

1.2 Statement of the Problem

As discussed earlier, it appears much has not been done on the potential causality nexus that might exist among globalization, energy consumption and carbon emissions in literature and most especially for economy of Turkey that are known to be importer/exporter of energy products (Shahbaz *et al*., 2016, 2017; Overland, 2016; Leit, 2014; Chen and Chen, 2011). Turkey's energy import dependency, mainly on oil and natural gas is increasing due to the growing energy demand as Turkey gets globalized through trade. Thus, one would be theoretically right to assume that the increase in energy consumption over the years in this economy is due to

globalization and that might influence the level of carbon emissions, hence erode environmental quality. If this increase in energy demand is not curtailed, this might have an adverse impact on both the present and future generation.

On the other hand, in empirical analysis, directions of causalities are established on sound economic theories. This is done in order to examine the dynamic causality between macroeconomics variables, which will also help in carrying out hypotheses testing. Understanding causality relationship and its direction will assist policymakers in economic policy decision making, since the past and future values in one variable contain additional information about the future of another variable, which is not included in the past and future of the variable under observation. Thus, this study seeks to examine the possible relationships that exist between the variables of interest for an emerging economy of Turkey.

In this study, we intend to examine the direction of causality relationship between globalization and energy consumption. To control omitted variable bias, we employ carbon emissions and economic growth as an additional or control variables. Inclusion of these variables, we help us to make a sound and valid empirical analysis about the interaction between the variables of interest and its attendant impact on the Turkish economy. We intend to examine channels through which globalization influences energy consumption whether the causality relationship follow two-sided, one-sided or non-causality. Ability to substantiate the direction of causality between the variables under observations would help us to analyze its impact on environmental quality and trade of Turkey.

1.3 Objective and Significance of the Study

There are several and crucial reasons why it become expedient to investigate causality relationship between energy consumption and globalization index. The first reason is due to the future energy demand and the environmental effects of CO_2 emissions (Shahbaz *et al.* 2017). Secondly, the increase in the level of energy use/consumption has been reported in literature to directly relate with economic activities, while on the other hand, it has also been argued that, enhancing economic growth and development requires more energy utilization. It is paramount to note that, an increase in energy regulation can offset for certain components and not all the rise in energy consumption levels.

Thus, this study examines the possible relationships that exist between the globalization index, carbon emissions and energy consumption. We intend to examine channels through which globalization influences energy consumption and thereby influences environmental quality (through carbon dioxide emissions). In addition, we seek to examine whether the causality relationships between these macroeconomic variables follow two-sided, one-sided or non-causality. Ability to substantiate the direction of causality between the variables under observations would help us to examine its impact on the environmental quality and trade of Turkey. Understanding the intrinsic relationships between the variables under observation serves as a tool for government and policymakers in the sampled country when making economic and environmental policy decisions that would protect both the present and future generation from the grievous impact of environmental pollutions, as a result of increase in energy demands and hence carbon dioxide emissions.

1.4 Research Methodology

In this study, we employ time series econometric techniques to investigate whether globalization and energy consumption Granger cause one another or not. We seek to examine whether globalization and energy consumption is a useful predictor of one another. That is, we examine the direction of dynamic causality relationship between energy consumption and the newly introduced globalization index in the case of Turkey over the periods 1980-2014. In order to control for omitted variable bias and thoroughly understand the relationship between the variable under observation, we incorporate real GDP per capita and carbon dioxide emissions as additional variable to proxy for economic growth and environmental quality respectively.

Time series data were sourced from the World Development Indicator (WDI). Although, data for globalization and energy consumption is available until 2017, however, data for carbon emissions is only available until 2014. Thus, the data is restricted to 2014 based on data availability. In order to carry out robust empirical analysis, first we test for stationarity properties of the time series data, using conventional time series unit roots testing methods, after which we conduct the long-run cointegration test to investigate whether there is an existence of a long-run equilibrium nexus between the variables under observation. Lastly, to achieve our study objectives, we conduct time series Granger causality using Toda-Yamamoto (1995) techniques. This is done to examine whether the variables under observation have predictive power over one another or not. The outcome of this study, will help policymakers in Turkey in making policy decisions that would curb environmental impact of increase/decrease in globalization and energy demands.

1.5 Research Outline

The structure of this study is as follows; in chapter one we briefly introduced the research and discuss study motivation. In chapter two we review the literature based on theory and empirical investigation on previous studies on related topics and briefly examine Turkish energy market in order to gain an insight into the functioning of the market and how important these macroeconomic variables are to the economy of Turkey. Chapter three entails the selected research methodology for the empirical analysis, while in chapter four we discuss results and empirical findings. Lastly, in chapter five, we summarize the study and proffer policy suggestions.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

In this section, we discuss the theoretical relationships between globalization and energy consumption, between globalization and carbon emissions, energy consumption and carbon emissions, the interaction between globalization, energy consumption and an insight into the Turkish energy market.

2.2 Globalization and Energy Consumption

The term globalization can be describe as a process of integration and interaction between the people, firms, private and/or public institutions of various countries, which is driven by foreign direct investment, capital outflow and trade and supported by information technology. The globalization process has impacts on the culture, environment, economic development and prosperity, political systems, and on human well-being in nations of the world (Marber, 2005; Giddens, 2018).

Notwithstanding the fact that globalization is not newly discovered. For over century now, individuals and/or businesses have been engaging in buying and selling from/to each other at long distances, most especially via Europe during the middle ages the prominent Silk Road beyond Central Asia through China. Similarly, they have invested in institutions in other nations. As a matter of fact, several of the characteristics of the recent swing of globalization are in common with those ruling before the outburst of the World War I in 1914 (Levin, 2017; Levitt, 1993)

However, technological advancement and policy developments over the years have encouraged increases in investment, over the border trade, and migration in such a way that, many onlookers was of the opinion that the world has moved to a new era in its economic development. For example, since 1950, the magnitude of global trade has risen 20 times, while between 1997 and 1999, the flows of international trade and investment almost doubled, from US$468 to US$827 billion (Levin 2017; World Commission on the Social Dimension of Globalization, 2004). Recognizing this recent swing of globalization from previous ones, Friedman argued that, the globalization we are experiencing today is faster, farther, deeper and cheaper.

Energy consumption on the other hand is the unit of energy consumed in a system or process, or by an individual, businesses or a nation. In other word, energy consumption is the aggregate energy consumed by human civilization, which is specifically measured annually. It entails every energy sourced from all energy source applied regarding humans and economic endeavors across every single technological and industrial sector, across every nation. Energy consumption does not include energy sourced from food, and the magnitude to which direct biomass burning has been controlled for is not adequately reported. For being the power root measure of civilization, energy consumption has an extensive implication for human socio-political-economic sphere.

Globalization has become one of the most significant tool economies of the world is using to restructure nations towards a rapid economic growth and development, to the extent that, economies of the world is currently experiencing a significant swift from a disintegrated and feeble world economy to a strong and sound integrated world economy due to the influence of globalization. In addition, energy

consumption has facilitated increases in foreign trade and technological transfer as a result of globalization. The interaction between these economic variables now exerts a significant impact on economic activities that may have positively or negatively influence economic performances all over the world (Shahbaz et al., 2018).

Based on the illustration above, it will be theoretically right to assume that, the impact of globalization in terms of economics have been attributed to the significant increases in energy demand or consumption, while increase in energy consumption necessitates or comes with environmental degradation or pollution (Marber, 2005). It is paramount to state here that, as the environment degenerate or environmental pollution increases, this retard economic performance and in addition leads to climate change related with greenhouse gas emissions. Marber (2005) argued that about 3 billion people or more consumes energy globally, and in years to come, the world will be confronted with energy resource shortage. Harris (2001) on the other hand, reported that energy demand across the nations via the channel of globalization is growing through international trade, deregulation of indigenous markets, industrial restructuring and mix-investments that links the historic energy markets to the modern world political economy. The energy markets and industries transformations observed in world economies creates significant prospect when it comes to energy efficiency, consumer choice and technology development.

Furthermore, globalization as an engine of freer markets, burgeoning of human capital and agent of cross-border integration have in one way or the other created a new world order that has attracted growing attention among policymakers and researchers. Marber (2005) in his analysis, pointed out that despite the positive effects of globalization there are still more to be achieved through globalization. He

argued that globalization is a necessary solution and not sufficient solution to problem or person at every point in time. The term globalization seems to be complex more than what one can think of or assume as it involves a chain of interconnected nexus which can exist either for a shorter time or longer time frame.

Saudi Arabia Oil Minister, in the person of Ali Naimi, in his speech before the Council on Foreign Relation (CFR) and World Affairs Council of Northern California (WACNC) May 2005, admitted that globalization have the capacity of generating a living standard that is affordable for the world's population. Although, he argued that the process would have to be taken well adequately supervised. Similarly, Naimi (2005) reported that world economies would be confronted with tradeoffs in order to balance tradition, quality of life, culture, with the environment, and hence, economic growth. However, in order to be optimistic concerning the benefits of globalization either to the individuals or economy as a whole, it is crucial to comprehend the remarkable role of energy. There is no nation that can grow without using energy either as an input in production or output for consumption. That is, economic activities require energy resources to produce goods and then convey them to the final markets to meet consumers' needs and consumptions. After all, energy makes available to the nations of the world several conveniences of life without which economic activities might be impossible (Naimi, 2005).

As the world is becoming more and better globalized, energy resources has now perceived as an investment asset associated with currencies, equities and bond. Oil futures and over the counter markets are presently gaining huge investment attention from hedge funds and institutional investors striving to maximize profits. However, several of these investment decisions are based on expected returns in relation to

alternative investments rather than on current market fundamentals. Thus, it becomes more tedious to control the markets as a result of huge investment funds required. It appears globalization has the capacity to enlarge the world economy and in addition generate an unparalleled demand for supplemental oil (International Energy Agency, 2007).

Energy demand is projected to increase by 55% with its consumption increasing from 11.4 billion tons to 17.7 billion tons of oil equivalent between the years 2005-2030 (International Energy Agency, 2007). This projection is basically for the developing countries, with oil, coal and gas mutually accounting for the bigger proportion of the world primary energy usage. Meanwhile, per capita energy consumption is a good measure of a nation's level of economic growth and development. Energy is required for a well-developed service, transportation of goods, services and people either for leisure and/or work couple with functioning communication and manufacturing sectors. Increase in energy usage is as a result of high concentration of industry, high levels of car ownership and increased domestic consumption for homes furnished with electronic appliances.

Overland (2016) in his opinion argued that advocating for energy would steer up the military strength and economic growth of a nation while, Yatchew (2014) in his empirical analysis argued that, championing for energy is a primary driver of human history. It is interesting to know that, most of the world's biggest multinational companies are basically into oil. Some of the largest foreign oil companies are mostly situated in oil producing countries of the world, with capital intensive investments (running into billions $USD) in most of them, with huge number of

workers dispersed all around the world where these firms are located (ExxonMobil Worldwide Operations, 2016; BP Worldwide, 2016).

Going by the above illustrations, energy appears to be crucial to globalization. However, the inadequacy of the interaction and relationship between these variables in the energy literature seems to be a gap that requires utmost attention by researchers for effective policy makings. This paper investigates causal nexus between the variables under observation. As discussed earlier, we seek to examine whether globalization and energy consumption are useful predictor over one another and the impact of their relationship on environmental quality both for the immediate and future generation in the case of Turkey.

2.3 Globalization and the Environment

Trade openness and its attendant impact, free trade, are both manifestations and drivers of globalization. These are mediums through which globalization influences the environment and erodes environmental quality (Panayotou, 2000). Globally, international trade has risen faster than output, implying a rising trade-intensity of the world economy. Global output was reported to grow at yearly average rate of 4 percent between the periods 1950 to 1954, while the global merchandise trade rose yearly, at an average rate of over 6 percent in the same periods. Consequently, over the 5 decades, global trade rose 14 percent compared to 5.5 percent of global output. According to the World Trade Organization (1995) report, the trade potency of the world economy grew further over the periods 1990-1995.

International trade theory has shown that free trade optimizes the efficiency of allocating resources by putting economic activities to efficient (least) cost producers;

which in turn produces a certain level of output at the an efficient (least) cost. Thus, if environmental resources are optimally priced the world output as a result of from free trade is also created at the efficient environmental cost. On the other hand, free trade optimizes social welfare in any economy. For an instance, nations with high levels of energy importation use more non-renewable energy such as fossil fuels than countries with low level of trade protection. In such a situation, trade liberalization would increase the consumption of non-renewable energy and hence environmental pollution in highly protected countries and this increases slightly in low trade protectionist countries. Consequently, this would lead to general benefits in environmental sustainability and protection. On the other hand, if there are policies or market failures that are not controlled for, this will lead to misallocation of resources and removal of trade barriers may aggravate the situation. In such condition, free trade would not optimize social welfare of such nation. Although, efficiency benefits will still be in place, however, these will also facilitate welfare losses, as resources become wasteful and environmental pollution are compounded. The net impact of globalization through the channels of trade liberalization and free trade on social welfare would rely on the relative extent of the negative and positive impacts.

There are few studies that attempt to examine and also compare the efficiency benefits from globalization via trade liberalization with the costs of grown environmental pollution. Repetto (1993) analyzed these variables and reported that there is no specific expectation for giving relevance to global trade policy over environmental policy. Globalization through trade liberalization exercise impacts on the environment, through the scale of economic activity, changes in structure of

economic activity, income growth, product composition, trade-induced regulations and technology diffusion (Panayotou, 2000).

2.4 Energy and the Environment

Energy have often been and will always be related with the environment. Most of the energy sources are usually at bottom, either obtained or reproduced from the environment. Once energy is consumed, it ultimately goes back to the environment either as a non-addictive byproduct or as dangerous waste or emissions. As energy consumption has risen around the globe, the impacts of this consumption possess intensified effects on the environment (Ristinen, Kraushaar & Brack, 2006). In addition, globalization has enhanced the rate of these advancements and certified that the policy decisions of one nation are perceived more deeply in several other countries.

Furthermore, the nexus between energy and the environment is solely explained by the concept of economic externalities (Chigier, 1981). The term externality is an indirect or hidden cost related with human, economic or production activities or through transaction of business activities. Since the burden of this cost usually felt by those who have no business with such transaction, this is not included as a component in the market price. For an instance, the price one pays for a pint of gasoline may not necessary reveal the actual or entire costs that carbon dioxide emissions emanating from the burning of such gasoline inflict on the entire society (Yang & Jackson, 2012).

Wirth et al (2003) argued that the market prices obtained from the interaction between the invisible forces of demand and supply are wide notion of cost that

account for the entire social costs incurred by those directly partake in the transaction, couple with the external parties affected by it. This social cost is specifically crucial when public goods such as clean water or air are involved. It is usually believed that, because a collective resource is owned by people in theory, it is owned by nobody in practice. Thus, the benefits obtained as a result of economic activities that use the environment, for example, driving a car or burning coal are deeply rooted between the drivers or energy companies (Wirth et al., 2003).

However, the actual costs of such economic activities are majorly spread among the population, for example, spreading across the people in neighboring nations (Wirth et al., 2003), who specifically have no business with the burning of these emissions but in one way or another have to breathe in a car's exhaust fumes (Ristinen, Kraushaar & Brack, 2006). This indicates that no one in particular will take responsibility for the entire social costs of this his/her activities. In such a situation, governments or policymakers can intervene by bringing the market cost of a specific economic activity to be in tune with the entire social cost. This government intervention entails assessing the disparities among market and social cost and also imposing tax structure that specifically increases the market cost (Yang & Jackson, 2012). This is refer to as internalizing the externality. Economic externalities and the manner at which governments handle them is central linkage between energy and the environment. Finally, it is crucial to note that the contending needs of energy consumers and environmental protection policies must be carefully executed if any meaningful economic growth is to be robust and sustainable in the long-run (Chigier, 1981).

2.5 Globalization, Energy Consumption and Environment

Chang et al (2013) in their analysis examine the impact of globalization and energy exports on economic growth. The study employ bias-corrected least square dummy variable (BC-LSDV) model approach for a panel-based of five South Caucasus nations between the periods of 1990 to 2009. Empirical findings show that, increase in globalization and energy exports increases economic growth. In addition, the study report that, increase in the level of energy exports yield higher economic growth due to globalization, thus, increase in energy exports stimulate a rise in economic growth, specifically when economic and political integration was controlled for.

Shahbaz, Mallick, Mahalik and Sadorsky (2016) in their empirical analysis reveals that energy demand reduces due to the influence of globalization. They found that energy consumption is inversely related with financial development, but positively associated with economic growth. An empirical result on Granger causality relationships shows a two-way causality relationship between energy consumption and globalization. They concluded their findings by confirming that energy consumption/demand positively influence economic globalization.

In the same vein, Shahbaz *et al* (2017) in their study argued that, there is an increase in per capita energy consumption of some high income countries, specifically the OECD. Energy consumption increases from 4537kg to 5103kg between 1980 and 2007. The figure significantly reduced to 4683 kg in 2013 due to the effect financial crisis of 2007-2008. This event drastically slowed down economic performance of the world economies. The OECD, are currently consuming more energy per capita than they did 30 years ago, despite the rise in energy efficiency. It appears that safe

and sound energy supply is an important ingredient when working towards achieving economic growth and/or development. Furthermore, anticipated energy supply is perceived as being dependent upon projections of expected energy consumption.

Conclusively, the possible effects of globalization on energy consumption and the attendant impact on the environmental quality is an adequate motivation to investigate the causal nexus between the variables under observation. Baek, Cho and Koo (2009), Copeland (2005) and Copeland and Taylor (1994) investigated the environmental effects of trade liberalization. It was argued that, since globalization appears to be a significant factor influencing energy consumption, thus, it may directly or indirectly influence environmental quality be it in developing, emerging and developed nations. (Shahbaz et al, 2015; 2016).

Lastly, it has been reported that about 65% of world CO_2 emissions emanate from fossil fuels consumption which are probably the major sources of energy in most of the developing, emerging and even some developed countries of the world (Shahbaz, 2015). We hypothesized that, the existence of a causality relationship between energy consumption and globalization would have significant consequences on environmental quality which we measure as for carbon dioxide emissions. Our motive is to test the direction of this causality relationship between these variables and make policy suggestions to prevent its attendant impact on the environmental quality of Turkey

2.6 Turkey Energy Market

This section discussed Turkish energy market overtime. Annually, Turkish economy consumes primary energy of about 1700 terawatt hours. This is over

20 megawatt hours per head. Most of the energy consumed in Turkey are imported, such as fossil fuels; however, policy is being put in place to reduce consumption of fossil fuels due to its higher emissions of carbons, including producing more electricity at the western part of the country to meet up with energy demand.

Over 3 decades ago, yearly consumption of primary energy has almost tripled to 1700 terawatt hours in 2016; which includes 27 percent coal; 28 percent gas and 31 percent oil. In addition, carbon dioxide emissions generated through fuel combustion have increased from its initial 130 to 340 megatons. (International Energy Agency, 2015). Most of fossil fuels products asides brown coal (lignite) is imported. It is paramount to state here that, Turkey's energy policy is tailored towards reducing the proportion of energy imports.

Electricity in Turkey is basically produced from hydro, gas and coal couple with a renewable energy source (although at smaller amount) which includes solar and wind power with nuclear power plants in construction phase (International Energy Agency, 2015). Turkey generates a significant amount of brown coal (lignite), which most of it is created in power stations (Unlu et al., 2017) which produced out huge units of carbon emissions with a relatively low efficiency level. Although, government of Turkey often subsidizes coal-fired power stations, no matter the environmental effect of the industry, with the motive to build more coal-fired power stations to complement the available ones.

In addition, according to International Energy Agency (2015) report, Turkey economy annual gas demand is 50bcm, while more than 30 percent of their aggregate energy demand is imported from Russia. Thus, Russia is the largest supplier of

energy source to Turkey. There are about 81 provinces in Turkey, and all these provinces consumes and depend on natural gas as a source of heat (International Energy Agency, 2015). The Turk-Stream pipeline that would link Turkey to Russia over the years have been under construction. Thus, most energy products are being moved to Turkey through the Blue-Stream pipeline from Russia. On the other hand, Turkey also import gas from Iran and Azerbaijan. Most of these Iranian gases comes via the Tabriz–Ankara pipeline and Azerbaijan via the Trans-Anatolian gas pipeline, and through South-Caucasus pipeline, which has been argued to be the cheapest for Turkey. Turkey is expected to trade in gas with Iraq in future via the Southern Gas Corridor while Eastern Mediterranean gas deal is still under observation (International Energy Agency, 2015). Furthermore, 16.5 percent of gas is imported as liquefied natural gas (LNG). These alongside storage is crucial for meeting the peak demand in the winter season (International Energy Agency, 2015).

Lastly, it appears that small proportions of imported gas are re-exported to the European Union countries. Although, Turkey is working towards becoming the biggest gas trading country in the world and also re-export more by the end 2018 (International Energy Agency, 2015). The state-owned BOTAŞ is in controls of about 80 percent of the energy market, while 91 megatons of carbon dioxide were emitted via natural gas in 2015 (International Energy Agency). Conclusively, at the moment Turkey has no operational nuclear reactors, however, the nation is building its first nuclear power plant at Akkuyu, which is with anticipated to commence operation in 2023, with more of this nuclear power plant to be built in years to come.

Chapter 3

DATA AND METHODOLOGY

3.1 Data and Variables Description

This study employs time series econometric techniques as reported in section 1. The purpose of this research is to examine whether causality relationship exist between globalization and energy consumption for Turkey and its implication on environmental quality. In order to control for omission variable bias, we employ real GDP per capita and carbon dioxide emissions as an additional variables to proxy for economic growth and environmental quality over the periods of 1980-2014. We obtain data from World Bank Development Indicators (WDI). Although, data for globalization and energy consumption is available until 2017, however, data for carbon emissions is only available until 2014. Thus, the data is restricted to 2014 based on data availability.

The variables are discussed below:

- Carbon dioxide emissions (CO_2): CO_2 emissions are generated from burning of fossil fuels and through the production of cement. These include CO_2 emissions created via usage of liquid, solid, gas flaring and gas fuels. CO_2 emissions are measured in per capita metric tons.
- Economic growth (RGDP): The real per capita gross domestic product is used to measure economic growth. This is the sum of gross value added by resident producers in a nation, in addition with product taxes and excluding

subsidies in the value of the products. Real per capita GDP is in constant 2010 USD.

- Energy consumption (EC): Energy use is proxy for energy consumption and this is measured in per capita kg equivalent. It is the use of primary energy before transforming it into other end-use fuels. This is equivalent to domestic production in addition with stock changes and imports less fuels supplied and exports to aircraft and ships involved in foreign transport services
- Globalization (Glob): We employ newly introduced globalization index by Dreher (2006). This index was updated recently by Gygli, Savina, Florian Haelg and Jan-Egbert Sturm (2018). It incorporates crucial measures of globalization such as economic, political and social-cultural globalization.

Table 1: Summary Statistics for the Variables

	CO2	EC	GLOB	RGDP
Mean	2.766	1012.568	55.428	7390.625
Median	2.724	976.489	55.404	6889.817
Maximum	4.491	1585.400	71.377	13312.46
Minimum	1.222	522.199	41.540	4221.158
Std. Dev.	0.945	303.076	10.260	2436.428
Skewness	0.205	0.336	0.029	0.761
Kurtosis	1.925	2.050	1.431	2.651
Jarque-Bera	2.482	2.542	4.622	4.582
Probability	0.289	0.280	0.099	0.101
Sum	124.505	45565.57	2494.261	332578.1
Sum Sq. Dev.	39.141	4041643.	4631.881	2.610
Observations	45	45	45	45

Table 1 present the time series summary statistics for variables under observation. The mean, median, maximum, minimum, standard deviation, skewness, Kurtosis and Jarque-Bera for normality test were all reported. Based on the Jarque-Bera insignificant statistics, we conclude that the variables are normally distributed, as we

could not reject the null hypothesis of normal distribution at all significance levels, except for globalization that was found weakly significant at ($p < 0.10$) significance level.

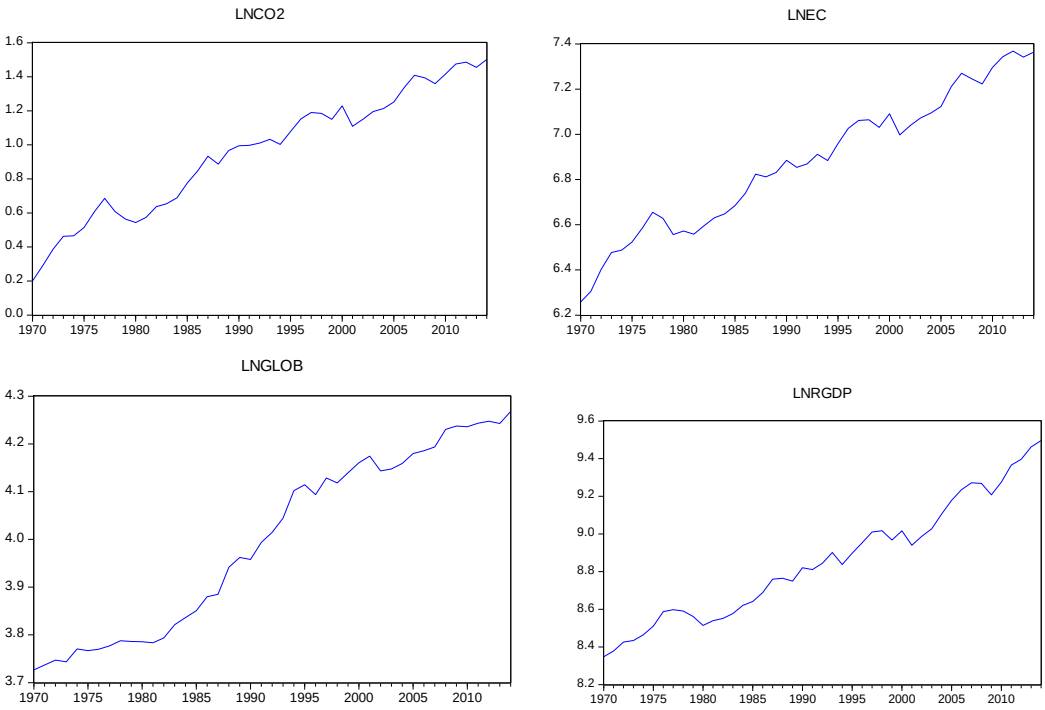

Figure 1: Time series plot of sampled variables in natural logarithm form.

From the time series plot, we observed that, carbon emissions, energy consumption, globalization index and real GDP per capita trend upward over the sampled periods. This indicates that, environmental pollution (carbon dioxide emissions) on the increase with the rise in energy consumption, globalization and economic growth. It appears environmental policy of Turkey are not in tune with their macroeconomic objectives, as environmental quality degraded overtime. Thus, much have not been achieved in terms of sustaining the environment from the impacts of carbon dioxide emissions. Similarly, we found that, energy consumption, globalization and economic growth has also been growing overtime. Increase in globalization has had positive and significant impact on the level of energy usage and thus increase in real

income. The positive trend of globalization, energy consumption and real income could be seen as a blessing to Turkey, however, attendant effect on the environment must be put into considerations and prioritize energy policy that would sustain the environment and economy of Turkey as a whole.

3.2 Methodology

This study employ time-series multivariate econometric model to examine causal relationships between globalization, energy consumption, carbon emissions and economic growth. For better understanding of the implicit and explicit functional relationships that exist between the variables of interest, we specified our empirical model as follow:

$$CO2_t = f\left(\mathrm{EC}_t^{\beta_1}, \mathrm{GLOB}_t^{\beta_2}, RGDP_t^{\beta_3}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots... (1)$$

Equation (1) can be written in natural logarithm form as follows:

$$\mathrm{lnCO}_{2t} = \beta_0 + \beta_1 \,\mathrm{lnEC}_t + \beta_2 GLOB_t + \beta_3 \ln RGDP_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.$$

(2)

where lnCO_2, lnEC, lnGLOB and lnRGDP represent the natural log of carbon emissions, energy consumption, globalization and economic growth, β_i (1, 2, 3) represent slope parameters and ε_t the stochastic terms. In this model, it is expected that, increase/decrease in energy consumption, globalization and real income would lead to increase/decrease in environmental pollution (carbon emissions) *ceteris paribus*.

3.2.1 Time Series Unit Root Approach

An augmented Dickey and Fuller (1979), ADF test as popularly known examine the null hypothesis that there is an existence of a unit root against its alternative hypothesis of no presence of unit root in a time series data. This test is an augmented model of the DF test for more complicated and larger set of time series data. The

ADF statistic is often a negative number. However, the more negative the statistic, the higher the possibility of the null hypothesis rejection that there is an existence of a unit root at particular level of confidence.

The time series unit root testing framework for the ADF test is specified as follow;

$$\Delta x_t = \beta + \alpha t + \theta x_{t-1} + \gamma_1 \Delta x_{t-1} + ... + \gamma_{p-1} \Delta x_{t-p} + \mu_t \quad \text{..... (3)}$$

where, β is an intercept and α is the coefficient on the time trend while p the lag length in the autoregressive process. In addition, imposing $\beta = 0$ and $\alpha = 0$ that is the constraints, equate to modelling a stochastic term and making $\alpha = 0$ equate to modeling a stochastic term with a drift.

The ADF unit root test is conducted under the null $\theta = 0$ against its alternative of $\theta < 0$. Once the ADF unit root test statistic is computed it can be compared with its critical values. Regarding the decision process, if the ADF unit root test statistic is less than its critical value, we conclude that the null of $\theta = 0$ is rejected and the time series data is stationary either at level or first difference.

$$DF_T = \frac{\hat{\theta}}{SE\left(\hat{\theta}\right)}$$

Lastly, there are other types of time series unit root tests, which includes the ADF-GLS test framework advanced by Elliott, Rothenberg and Stock (1996) or Phillips–Perron (1988) unit root test.

For confirmatory analysis of the ADF unit root test results, we conducted Kwiatkowski, Phillips, Schmidt and Shin (1992) popularly known as KPSS unit root test. The KPSS (1992) unlike the ADF unit root test evaluate the null hypothesis of

stationarity against its alternative hypothesis of presence of a unit root in a time series data. The KPSS unit root type tests are conducted to complement Dickey and Fuller (1979) unit root tests. By conducting this test, one can distinguish series that have a unit root, series that are stationary and lastly series for which the data are not adequately informative enough to decide or conclude whether the series are integrated or stationary.

3.2.2 Johansen (1991) Cointegration Approach

In order to test for long-run cointegration relationships among variables under observation, we employ Johansen (1991) cointegration testing approach. This technique is a procedure for testing cointegration of multiple cointegration vector and for first difference $I(1)$ time series data. This test is generally more applicable than the Engle–Granger cointegration testing approach that produces single cointegration vector and built on the Dickey–Fuller (1979) unit root testing based on residuals of time series (Davidson and James, 2002).

Johansen cointegration testing is made of two test statistics, the trace statistic or the maximum eigenvalue statistic, and the inferences between the two tests statistics is little bit different. The trace statistic and max eigenvalue statistic usually produces same results. That is, they both accept or reject null hypothesis of no cointegration relationships. Although, at times, the trace and max-eigen statistics can generate conflicting results. This is often observe when the stationarity properties of the time series are not ascertained, that is, whether the time series data is integrated of order $I(1)$, $I(0)$ or partially integrated.

In addition, the null hypothesis for trace test statistic is built on the assumption that the number of cointegration vectors is $r = r^* < k$ against its alternative hypothesis of

$r = k$. This is conducted basically for $r^* = 1, 2, ...N$, while non-rejection of the null hypothesis is considered as an estimate of r. Similarly, the null hypothesis of the maximum eigenvalue test statistic is synonymous with the of trace statistic $r = r^* < k$, however, with a difference alternative hypothesis of $r = r^* + 1$ with testing procedure specifically conducted for $r^* = 1, 2, ...N$, with non-rejection of the null hypothesis is considered as an estimate of r. Like the unit root testing approach, Johansen cointegration can be conducted under the constant, trend, neither and/or both in the model.

For a general vector autoregressive model (VAR, p) the following equation is specified in equation 4:

$$y_t = \alpha + \gamma D_t + \beta y_{t-p} + ... + \beta_1 y_{t-1} + \mu_t, \; t = 1, ..., T \quad \text{..... (4)}$$

The error correction model (ECM) has two specifications, the long-run vector autoregressive model and the transitory vector autoregressive model.

The long-run vector autoregressive model is specified as follow in equation 5;

$$\Delta y_t = \alpha + \gamma D_t + \beta y_{t-p} + \theta_{p-1} \Delta y_{t-p+1} + ... + \theta_1 \Delta y_{t-1} + \mu_t, \; t = 1, ..., T \quad \text{..... (5)}$$

where, $\theta_i = \beta_1 + ...\beta_i - I,$ and $\mathrm{i} = 1, ...\mathrm{p}-1$

The transitory vector autoregressive model is specified as follow in equation 6;

$$\Delta y_t = \alpha_1 + t - 1\gamma D_t + \theta_{p-1} \Delta y_{t-p+1} - ... - \theta_1 \Delta y_{t-1} + \beta y_{t-1} + \mu_t, \; t = 1, ..., T \quad \text{..... (6)}$$

Where, $\beta = \beta_1 + ...\beta_{p-1}$.

Lastly, it is crucial to note that, influences are drawn on β which will be similar in both specification and in their independent variable(s) power.

3.2.3 Toda-Yamamoto (1995) Granger non-Causality Approach

This study employ Granger non-causality testing approach advanced by Toda and Yamamoto (1995) hence forth (T-Y) via Modified Wald statistic approach. Toda and Yamamoto (1995) method of non-Granger causality been tested and reported to generate robust causality test statistic compared to the conventional methods that failed to adjust for potential non-stationarity properties and co-movement among time series data. In addition, this method also required $q_{\max}$ specification which is the optimal order of integration of the time series employed in the model. Although, the specified model has been intentionally over-fitted with an additional lag of ($q_{\max}$). This create a new VAR order of $p = q + q_{\max}$, which is established to show that the primary t-statistics have conventional asymptotic properties for Granger causality testing.

Toda and Yamamoto (1995) employed Modified Wald (MWald) test statistic approach for restrictions on the intercept of $\mathrm{VAR}(q)$ while parameter p denote the lag order. MWald test statistic is built on the assumption of asymptotic chi-square distribution of $\mathrm{VAR}(q + q_{\max})$. Consequently, TY (1995) Granger non-causality testing specified for the model in shown in the vector autoregressive model via seemingly unrelated regression (SUR) in equation 7.

$$\begin{pmatrix} \Delta \ln \mathrm{CO}_{2t} \\ \Delta \ln \mathrm{EC}_{t} \\ \Delta \ln \mathrm{GLOB}_{t} \\ \Delta \ln RGDP_{t} \end{pmatrix} = \begin{pmatrix} Y_{10} \\ Y_{20} \\ Y_{30} \\ Y_{40} \end{pmatrix} + \sum_{b=1}^{q} \begin{pmatrix} Y_{11,\mathrm{b}}^{1} & Y_{12,\mathrm{b}}^{1} & Y_{13,\mathrm{b}}^{1} \\ Y_{21,\mathrm{b}}^{1} & Y_{22,\mathrm{b}}^{1} & Y_{23,\mathrm{b}}^{1} \\ Y_{31,\mathrm{b}}^{1} & Y_{32,\mathrm{b}}^{1} & Y_{33,\mathrm{b}}^{1} \\ Y_{41,b}^{1} & Y_{42,b}^{1} & Y_{43,b}^{1} \end{pmatrix} \times \begin{pmatrix} \Delta \ln \mathrm{CO}_{2t-b} \\ \Delta \ln \mathrm{EC}_{t-b} \\ \Delta \ln \mathrm{GLOB}_{t-b} \\ \Delta \ln RGDP_{t-b} \end{pmatrix}$$

$$+ \sum_{a=q+1}^{q_{\max}} \begin{pmatrix} Y_{11,\mathrm{a}}^{1} & Y_{12,\mathrm{a}}^{1} & Y_{13,\mathrm{a}}^{1} \\ Y_{21,\mathrm{a}}^{1} & Y_{22,\mathrm{a}}^{1} & Y_{23,\mathrm{a}}^{1} \\ Y_{31,\mathrm{a}}^{1} & Y_{32,\mathrm{a}}^{1} & Y_{33,\mathrm{a}}^{1} \\ Y_{41,a}^{1} & Y_{42,a}^{1} & Y_{43,a}^{1} \end{pmatrix} \times \begin{pmatrix} \Delta \ln \mathrm{CO}_{2t-b} \\ \Delta \ln \mathrm{EC}_{t-b} \\ \Delta \ln \mathrm{GLOB}_{t-b} \\ \Delta \ln RGDP_{t-b} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1.t} \\ \varepsilon_{2,t} \\ \varepsilon_{3,t} \\ \varepsilon_{4,t} \end{pmatrix} \qquad (7)$$

Conclusively, Toda and Yamamoto (1995) non-Granger causality testing approach has been argued to be superior over other conventional causality testing methods. One of the reason being that, Toda and Yamamoto type of Granger non-causality technique do not require particular information about order of integration of the variables of interest. Toda and Yamamoto (1995) can be used when time series rank specification are unfulfilled and stationary properties is unknown, once the order of integration of the data is the same with the lag length selected for model.

Chapter 4

RESULTS AND EMPIRICAL DISCUSSION

4.1 Unit Root Test Results

In this section, we present various estimation results conducted for study empirical analysis, which includes the time series unit root results, Johansen (1991) cointegration result and Toda and Yamamoto (1995) Granger non-causality testing results from the time series-based econometric techniques employed as discussed in section 3.2. In Table 2 and Table 3 we report the time series unit root results for ADF (1979) and KPSS (1992). Results in Table 2 reveal that, we could not reject the null hypothesis of an existence of a unit root for most of the variables under observations, when the unit root test was conducted under intercept and intercept plus trend specifications in level form. Having confirmed the non-rejection of the null hypothesis in levels form, we subject the time series data to first difference stationarity test. Empirical results show that, the time series data were all stationary at a ($p < 0.01$) significance level when the variables were differenced. Thus, we conclude that the variables under observation are integrated at order one, i.e., $I(1)$.

Table 3 results conducted under KPSS-type of unit root serve as a confirmatory test to the ADF test. This is done in order to control loss of power problem usually encounter in ADF unit root testing procedure. Table 3 confirmed the results that the variables of interest are integrated at first order.

Table 2: ADF Unit Root Test Results

Variable	Lag	t_I	Lag	t_T
$LNCO_2$				
Level	0	-1.695 (0.426)	0	-3.368* (0.068)
Δ	0	-6.218*** (0.000)	0	-6.224*** (0.000)
LNEC				
level	0	-1.354 (0.595)	0	-3.571** (0.044)
Δ	0	-6.219*** (0.000)	0	-6.210*** (0.000)
LNGLOB				
level	0	-0.321 (0.913)	0	-1.567 (0.789)
Δ	0	-6.576*** (0.000)	0	-6.494*** (0.000)
LNRGDP				
level	0	0.461 (0.983)	0	-1.959 (0.606)
Δ	0	-6.267*** (0.000)	0	-6.303*** (0.000)

*Note: Variables are significant at *** ($p < 0.01$) significant level.* t_I and t_T represent unit root test under intercept and intercept plus trend at individual lag order while Δ *represent unit root estimations at first difference*

Table 3: KPSS Unit Root Test Results

Variable	Bandwidth	t_I	Bandwidth	t_T
$LNCO_2$				
level	5	0.858 (0.463)	4	0.126* (0.146)
Δ	4	0.170*** (0.463)	5	0.059*** (0.146)
LNEC				
level	5	0.865 (0.463)	3	0.048*** (0.146)
Δ	3	0.108*** (0.463)	3	0.058*** (0.146)
LNGLOB				
level	5	0.835 (0.463)	5	0.110** (0.146)
Δ	3	0.139*** (0.463)	3	0.138*** (0.146)
LNRGDP				
level	5	0.860 (0.463)	4	0.144 (0.146)
Δ	2	0.113*** (0.463)	3	0.048*** (0.146)

*Note: Variables are significant at *** ($p < 0.01$) significant level.* t_I and t_T represent unit root test under intercept and intercept plus trend at individual lag order, while Δ *represent unit root estimations at first difference.*

4.2 Cointegration Test Result

Having report stationarity properties of the time series data employed in Table 2, and conclude that variables are integrated at first order, we proceed to long-run equilibrium cointegration testing. In Table 4, we report results for cointegration test estimated. Results show presence of one strong and one weak cointegration vector at

a ($p < 0.01$), ($p < 0.05$) and ($p < 0.10$) significance level. Thus, there is existence of two cointegration vector among the variables. As discussed earlier in section 3.2.2, testing for long-run equilibrium cointegration relationship is crucial for policy decision making. The reason being that, confirmation of a long-run equilibrium cointegration relationship indicates that, the observed variables, even if they wander in the short-run would converge towards the steady state in the long-run. Thus, the variables of interest have a stable long-run equilibrium relationship. Confirmation of cointegration relationship is important in empirical analysis, as absent of it could lead to spurious conclusion and unreliable policy making. This result is in line with Shahbaz et al. (2017) and Akadiri, Lasisi, Uzuner and Akadiri (2018).

Table 4: Johansen Cointegration Test Results

Hypothesized No. of CE(s)	Trace Statistics	*P*-value	Max-Eigen Statistic	*P*-value
None *	47.856***	0.009	27.829**	0.046
At most 1	29.797*	0.099	20.006*	0.071
At most 2	15.494	0.565	6.965	0.493
At most 3	3.841	0.713	0.135	0.713

Note: We found cointegrated vectors at *** 1%, ** 5% and * 10% significance levels.

4.3 Toda-Yamamoto Granger Causality Test Results

Having confirmed the existence of a long-run equilibrium cointegration relationship, we test for direction Granger causality relationships among the time series data. Granger causality examine whether let us say variable (X) Granger cause's (Y) or not, and vice versa. The method is meant to test how much of the current value of (X) can explain its past and future values, and whether the past and current values of (Y) can improve the past and future of (X) alone. For an instance, energy consumption is assume to Granger cause carbon emissions, provided energy

consumption helps in the prediction of environmental quality, or alternatively if the past values of the energy consumption in the prediction of past and future value of environmental quality is significant.

In addition, in empirical analysis, bi-directional causality, unidirectional causality and non-Granger causality is often the case. For example, bidirectional implies a two-ways causality relationship between variables. In such situation, we argue that (X) Granger cause (Y) and (Y) Granger cause (Y). This implies that (X) and (Y) have predictive power over one another. A unidirectional however implies a one-way causality relationship from one variable to another, i.e. (X) Granger cause (Y) but (Y) does not Granger cause (X) and vice versa. This indicate that, (X) have predictive power over (Y), however, the past and current values of (Y) does not have additional information about and sufficient enough to predict the past and future values of (X). Lastly, two variables can exhibit non-Granger causality relationship. This situation is popularly referred to as neutrality hypothesis. Neutrality hypothesis would exist between (X) and (Y), when past and current value of these variables have no additional information about the past and future values of one another.

For example, neutrality hypothesis between globalization and energy consumption implies that, increase and decrease in globalization would have no impact on the increase or decrease in energy consumption and that, increase or decrease in the level of energy demand is not as a result of globalization. In such situation, policy makers should not see globalization as a problem or contributing factor towards increase in the level of energy demand hence should not be included in energy policy decision making.

Table 5: Toda-Yamamoto (1995) Granger non-Causality Results

Null Hypothesis	Chi-sq.	*P*-value	Causality	Direction
LNCO2 → LNEC	0.521	0.770	*No*	...
LNEC → LNCO2	4.711*	0.094	*Weak*	*Uni.-*
LNCO2 → LNGLO	6.426**	0.040	*Strong*	...
LNGLO → LNCO2	11.065***	0.004	*Strong*	*Bi.-*
LNCO2 → LNGDP	1.131	0.567	*No*	...
LNGDP → LNCO2	1.582	0.453	*No*	*Non-*
LNEC → LNGLO	9.232***	0.009	*Strong*	...
LNGLO → LNEC	6.574**	0.037	*Strong*	*Bi.-*
LNEC → LNGDP	4.109	0.128	*No*	...
LNGDP → LNEC	0.918	0.631	*No*	*Non-*
LNGLO → LNGDP	4.814*	0.090	*Weak*	...
LNGDP → LNGLO	2.047	0.359	*No*	*Uni-*

*Note: The notation → implies that the variables do not Granger cause one another. Granger causality relationship are found *** (p <0.01), ** (p <0.05) and * (p <0.1o) significant level.*

Table 5 show estimation results for time series Granger non-causality using Toda and Yamamoto (1995) causality estimation technique. From the results, we found that, the null hypothesis of no Granger causality between CO_2 emissions and globalization and between energy consumption and globalization were rejected at ($p < 0.01$) and ($p < 0.05$) significant level. This implies that a bidirectional relationship exist between CO_2 emissions and globalization and between energy consumption and globalization. Thus, we conclude that, CO_2 emissions have predictive power globalization index and vice versa.

In addition, results show weak one-way causality relationship from energy consumption to CO_2 emissions and from globalization to economic growth. This implies that, energy consumption weakly Granger cause CO_2 emissions and globalization weakly Granger cause economic growth at a ($p < 0.10$) significance level. From these results, energy consumption appears to weakly predict CO_2 emissions level and globalization weakly predict economic growth in the sampled country. This result resonates with the findings of Akadiri et al (2018).

Lastly, from results reported in Table 5, we could not reject null hypothesis of no Granger causality relationship between CO_2 emissions and economic growth and between energy consumption and economic growth at all significance levels. This implies the existence of neutrality hypothesis between CO_2 emissions and economic growth and between energy consumption and economic growth in the sampled country over the study periods. CO_2 emissions and economic growth, energy consumption and economic growth appears not to have a predict power over one another.

4.4 Empirical Discussion

These empirical results have policy implications for the sampled country. First, the bidirectional causality relationship found between CO_2 emissions and globalization, indicates that increase or decrease in the level of environmental quality would influence economic, political and social globalization in Turkey. It appears environmental policy of Turkey is not in tune with their macroeconomic objectives and adequate enough to curb pollution level. This might affect the level at which other country interact in terms of trade. Most of the economies of the world are moving from consumption of fossil fuels and one of the priority of the United

Nations and Kyoto agreement signed in Paris is not curb greenhouse gas emissions. For example, France has reported that, buy 2040, automobiles that uses or produce fossil fuels would be eradicted.

Furthermore, the bidirectional causality relationship among energy consumption and globalition appears to be a serious issue for the Turkish economy. This implies that, energy demand and/or consumption increases, through the channel of globalization and vice versa, this would have attendant impact on the environmental quality of Turkey. Thus, it become expedient for Turkey to replace non-renewable with renewable energy source in order to enhance economic, political and social integration, which are the crucial components of globalization.

In addition, the one-way causality relationship reported from energy consumption to CO_2 emissions resonate with the previous studies on the energy consumption-carbon emissions relationship. It has been argued that, increase in energy consumption directly or indirectly enhances CO_2 emissions level (see Akadiri et al, 2017, 2018). The more the industries produce, the more automobile (transport facilities) moves around, and an electricity is been consumed among others, the higher would be economic activities, hence increase in carbon emissions level. Thus, Turkish economy must put in place sound economic and energy policy measure to reduce energy demand and industries that depends on fossil fuels for production, if any meaningful environmental pollution policy must be achieved. On the other hand, globalization also causes economic growth. This finding resonate with the work of Akadiri et al (2018) on tourism island states. This indicate that, increase or decrease in economic, political and social globalization of the Turkish economy would rather increases or decrease economic growth. Thus, more emphasis should be place on

economic, political and social interaction in economic policy decision making in the case of Turkey.

In conclusion, results also show that neutrality hypothesis between CO_2 emissions, energy consumption and economic growth respectively. One policy implication one can infer from this result is that, environmental pollution in the sampled country are not output driven. Although, it has been argued in energy literature that, embarking on energy conservation policies would hurt economic growth. However, this appears not to be the case of Turkey. The neutrality hypothesis between these variables, most especially between energy consumption and economic growth is an indication that introduction of energy conservation policy in order to curb carbon emissions and improve environmental quality would not slow down or retard economic activities, hence economic performance of Turkey.

Chapter 5

SUMMARY AND POLICY SUGGESTIONS

5.1 Summary

This study employs time series econometrics techniques to examine the direction of causality relationship between globalization, carbon emissions, energy consumption and economic growth in the case of Turkey. The objective of this research is to examine whether causality relationship exist between globalization and energy consumption for Turkey. In order to control for omission variable bias, we employ real GDP per capita and carbon dioxide emissions as an additional variables to proxy for economic growth and environmental quality over the periods of 1980-2014. We obtain data from World Bank Development Indicators (WDI). Although, data for globalization and energy consumption is available until 2017, however, data for carbon emissions is only available until 2014. Thus, the data is restricted to 2014 based on data availability.

For valid and sound empirical analysis, we test for time series stationarity properties via ADF (1979) unit root testing approach and confirmatory unit root testing method of KPSS (1992). Upon stationarity confirmation at first difference form, we conducted Johansen (1991) long-run equilibrium cointegration techniques to substantiate model stability and co-movement of variables towards the steady state path. Empirical results show at least two cointegration vectors, thus, we conclude

that, the time series variables are cointegrated and have stable long-run equilibrium relationships.

In order to achieve research objective, we conduct Granger causality test. From the test, we find bidirectional causality between CO_2 emissions and globalization and between energy consumption and globalization. In addition, results also show the presence of a unidirectional causality relationship running from energy consumption to CO_2 emissions and from globalization to economic growth. Lastly, we find neutrality hypothesis between CO_2 emissions and economic growth and between energy consumption and economic growth.

Conclusively, we are of the opinion that the bidirectional causality relationship established between globalization and energy consumption would have grievous impact on the environmental quality, as increase in energy demand through the channel of globalition via international trade would increase carbon emissions level in Turkey. In addition, results also show that environmental pollution in the sampled country are not output driven. Thus, energy conservation policies would not hurt or retard economic performance and hence, economic growth of Turkey. From our empirical, globalization and energy consumption appears to influence environmental pollution in the case of Turkey. These results resonate with the findings of Akadiri et al (2018).

5.2 Policy Suggestions

From the empirical results we have been able to sustantiate the relationship that exist between the variables under observation. Based on empirical findings, we have shown that, bidirectional causality relationship exist between globalization and

energy consumption in the case of Turkey, which is the main objective of the study. In addition, we found causality relationship running from globalization to CO_2 emissions and from energy consumption to CO_2 emissions. This indicates that, globalization and energy consumption are the principal factors that influences environmental quality in the case of Turkey. Thus, government and policymakers should consider alternative energy source such as renewable energy that produces little or no carbon emissions in the region, in order to curb environmental degragation for both the present and future generation. Reduction in importation of fossil fuels would go a long in achieving an healthy and sustainable environment for Turkish economy.

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