CURRENT DEBATES ON SUSTAINABLE DEVELOPMENT

Editors

PINAR HAYALOĞLU

SEYFETTİN ARTAN

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Pınar Hayaloğlu
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Edited by Pınar Hayaloğlu, Seyfettin Artan

IJOPEC Publication Limited
60 Westmeade Close Cheshunt,
Waltham Cross Hertfordshire
EN7 6JR London

www.ijopec.co.uk
info@ijopoc.co.uk
(+44) 73 875 2361 (UK)
(+90) 488 217 4007 (Turkey)

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Ahmet Gülmez
Sakarya University, Turkey

Atakan Durmaz
Samsun University, Turkey

Aykut Başoğlu
Karadeniz Technical University, Turkey

Aykut Ekinci
Samsun University, Turkey

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Yeşim Dindaroğlu
Karadeniz Technical University, Turkey

Yutong Li
UK, England

Yüksel Bayraktar
İstanbul University, Turkey

Introduction: Current Debates on Sustainable Development

Pınar Hayaloğlu (Gumushane University)
ORCID ID: 0000-0001-7181-8801
pinarhayaloglu@gumushane.edu.tr

Seyfettin Artan (Karadeniz Technical University)
ORCID ID: 0000-0003-4310-550X
artan@ktu.edu.tr

Determinants of growth and development have been one of the main topics discussed throughout the history of the economy. The primary goal of the countries is to increase welfare level and to make this in a sustainable way. Historically, some countries have grown rapidly, while others have not. This situation has always occupied the economic agenda on the cross-country differences of growth. Although factors such as physical and human capital, investments, and technology have mostly been put forward as the determinants of growth in traditional growth theories as suggested by the Classical economists, different approaches have arisen especially since the beginning of the 20th century. At the end of the 1960s, the increase in environmental degradation and its alarming economic effects directed attention to the relationship between environmental degradation and sustainable development. It has become essential to analyse the relationship between environment, growth, and development process and its impact. Endogenous growth models that emerged in the 1980s have placed technological development at the centre of their analysis which was pioneered by Romer (1986) and Lucas (1988) who argued innovation and R&D activities as the main source of growth. On the other hand, the institutional economic thought, which emerged as a view against the Neo-classics, argues that the institutional structure of the countries is a focal point in growth analysis. According to this view, developed countries grow faster through institutional factors such as economic and political freedoms, the level of democracy, control of corruption, and the rule of law, and such growth is sustainable.

This book aims to evaluate current approaches on the sustainable development. Considering historical change in the concept of development, the importance and necessity of adopting a human development and sustainable development approach have more recently emerged. The distribution and level of the production factors as main source of economic growth differ in developed and developing countries. Economic growth and development processes that emerge from this difference should be considered in the context of sustainability. Moreover, climate change and environmental problems are fundamental challenges for our world. Environmentally friendly policies, renewable energy, green capitalism, cleaner production and consumption processes should be addressed within the concept of sustainable development. Thus, we can recommend effective policies to the developing countries for alleviating poverty and inequality.

Growing literature on the green energy/capitalism, renewable/clean energy, and environmentally friendly production and consumption processes make sustainability concept more visible. Researches and studies about these concepts help to provide policy recommendations for the future. The book contributes to the growth and development literature by evaluating different development approaches. Additionally, given policy recommendations to support developing countries in the sustainable development process is another strength of this book.

This book is designed in four parts. The first part includes studies focusing on environmental development, which has become the main dynamic of sustainable development in recent years. There are four studies that examine the development process from an environmental point of view: Esra Karapınar Kocağ in her chapter provides important macro and micro level information on the environmental migration. Microeconomic theoretical background on the migration process is presented in the study and it is linked to current migration movements. Hikmet Gülçin Beken discusses environmental issues within the framework of sustainability and development. As a way of sustainability, the concepts of doughnut economics, green growth, and circular economy are analyzed to solve the trade-offs between economic growth and environmental issues. Environmental problems are discussed under the perspectives of sustainable development, green policies, and doughnut economics to integrate the dynamics of social and planetary limits. Mustafa Zuhal examines the relationship between environmental quality and economic sustainability of innovative environmental studies in terms of G-20 countries. He has demonstrated the positive effect of green innovation on sustainable environment and economic growth in his study. Nuri Baltacı & Hikmet Akyol analyze the effects of climate change on the level of sustainable development and agricultural sustainability in Turkey.

In the second part of the book, there are four studies that include macroeconomic policies: Yıldırım Beyazıt Çiçen summarizes the outlines of "The Narrow Corridor: States, Societies and the Fate of Freedom" book written by Daron Acemoğlu and examines the historical process of Turkey's narrow corridor experience. Seyfettin Artan, Pınar Hayaloğlu &

Selim Koray Demirel focuse on the role of trust in sustainable economic growth. In their chapter, they analyze the effect of trust in government on economic growth and happiness in EU-12 countries. Nuran Öztürk Ofluoğlu focuses on the role of women's employment in economic development in her study. She examines women's employment in OECD countries with a graphical analysis method. Pınar Koç highlighted nanotechnology, which stands out with its innovative production methods seen as the technology of the future in recent years. In this direction, the relationship between R&D expenditures, nanotechnology and economic development is investigated in the sample of G7 countries.

The third part of the book consists of studies dealing with growth and development within the scope of international trade and finance: In his chapter Ömer Faruk Kömürcüoğlu examines the roles that central banks can play in the process of sustainable development. The study evaluates the policy tools that will reduce environmental risks and support sustainable development in the policy implementations of central banks. Hikmet Akyol examines the relationship between agricultural credit utilization rates and sustainable development in 44 countries selected from the developing countries sample. He evaluates the impact of financial development on agricultural loans and sustainable development in the study. In his study, Onur İzmir focuses on the relationship between Corporate Social Responsibility (CRS) and financial performance. He aimes to provide contribution to the literature by identifying the possible reasons lying behind the inconsistencies in this relationship and suggesting a set of propositions to solve this chronic problem. Ayfer Özyılmaz discusses the positive and negative effects of transportation on income distribution through different channels. In the empirical part of the study, the effect of transportation infrastructure on income inequality is analyzed for 21 OECD countries by using econometric methods.

In recent years it has become important the use of clean and sustainable energy sources in production and consumption process with the increase in environmental degradation. The fourth part of the book consists of studies emphasizing the importance of energy policies in the context of sustainable development: In their chapter Abdulmecit Yıldırım, Sinan Erdoğan & İlyas Okumuş investigate the relationship between biomass consumption, ecological footprint and its components for Turkey. It is critical to reveal these relationships in order to determine the appropriate environmental policies in Turkey, where the consumption of primary energy resources is high. Mürşit Recepoğlu & Muharrem Akın Doğanay examine the relationship between renewable energy consumption, CO2 emissions and economic growth in their studies. The relationship between variables is analyzed for G-7 and BRICS-T countries with different income levels. Thus, the different aspects of the causal relationship between the variables according to income levels are revealed.

PART I

ENVIRONMENTAL DEVELOPMENT

1

Microeconomic Theoretical Aspects and Global Facts About Environmental Migration

Esra Karapınar Kocağ (Gumushane University)
esrakkocag@gumushane.edu.tr
ORCID: 0000-0002-2239-0519

Abstract

Climate change that has mostly been driven by human action has detrimental impacts on ecosystem. Although it is not clearly identifiable, general observation shows that climate change gives rise to extreme environmental events, unpredictable natural conditions, and potential risk on household livelihood. These consequences, in some of cases, ends with migration movements. Some projections show millions more people might migrate due to climate change related factors. Environmental migration, in this respect, becomes a crucial facet of climate change that requires a careful investigation to understand this phenomenon. This chapter, therefore, provides crucial insights into environmental migration from micro and macro levels. Microeconomic theoretical perspectives and useful data on types of events, numbers of died and displaced people, and economic loss that countries were faced are presented to emphasise the importance of the subject, as well as policy implications that could possibly help minimising adverse effects of climate change-related natural disasters.

Keywords: Climate Change, Environmental Migration, Migration Theories, NELM

JEL codes: Q54, O15, D6

1. Introduction

Climate change that shifts temperatures and weather patterns (UN, n.d.) influences human life in various ways. This change is reflected by increased temperature on Earth through increased usage of fossil fuels. As highlighted in 26th UN Climate Change Conference of the Parties Summit (COP26) in Glasgow in 2021, if human activities continue as it is, temperatures will carry on rising and causing even more destructive extreme weather events that will bring destruction of species.

As climate change accelerate and its destructive effects are faced by every country across the globe, its results and necessary measures to control it have become a crucial agenda for many countries. According to *Centre for Research on the Epidemiology of Disasters' (CRED) Emergency Events*

Database (EM-DAT), from 2000 to 2021 1,364,735 people died because of natural disasters across the world. CRED also reports that global occurrences of natural disasters has considerably increased since 2000. Economic loss in countries also increased considerably. According to Ritchie and Roser (2014), economic damage increased to 0.22 percent of GDP in 2010 from 0.09 per cent of GDP in 1960.

Environmental migration is one facet of climate change that influence millions of lives. Human migration might be seen as an adaptive response to poverty and social deprivation, as well as a response to environmental and climatic change (Scheffran et al., 2012). World Bank estimates that the number of people who migrates due to climate change-related reasons could reach to more than 140 million, as long as serious climate and development measures are not taken (Rigaud et al., 2018). Therefore, adverse effects of climate change seem to push considerable numbers of people away from their home.

Although migration is driven by diverse motives, it generally arises from the idea of material improvement (Massey et al., 1998). These motives that make people move have been discussed by researchers and politicians. However, there exist several different views and theoretical approaches. Standard economic models on the relocation of people assume that international differences in the returns to labour is the primary reason on individual decision to migrate (Bodvarsson & Van den Berg, 2013). This strong assumption of economic models is quite restrictive and they do not help to explain for example forced migration rather than pure economic migration.

Environmentally induced migration is not very easily identifiable since there are several individual and structural factors are likely to influence this type of movement. Micro-level migration theories attempt to present motivations to migrate somewhere else. From neoclassical perspective, migration decision is an individual decision to maximize expected outcome. However, this approach has been criticised by New Economics of Labour Migration (NELM) theory, saying that the entity that makes migration decision is not often an individual, instead it is a family that consider risk diversification over familial earning sources (Katz & Stark, 1986). Whether it is an individual decision or a household decision, migration phenomenon is a complicated concept that is caused by political, social and economic reasons, therefore, migration theory is needed to consider various reasons, forms, and causes (including environmental migration) as suggested by Doevenspeck (2011).

Developing countries experience a deeper effect of climate-change-related natural hazards. Generally speaking, necessary and preventive measures are not commonly taken in most developing countries. These measures can cover insurance systems, financial reserves to be used after an event, education and training to warn people about potential disasters and what to do, and so on. Therefore, country characteristics are also important for a better understanding of decision making of environmental migration and its consequences. In this respect, two major interconnected arguments arise, that are the weight of environmental/climatic factors in migration, and the connection among other push or pull factors such as a social, political, or economic nature (Piguet et al., 2011).

This chapter aims to provide valuable insight into the types and scales of natural disasters due to climate change and its controversial consequence, environmental migration for a wide audience which is interested in this hot topic. Together with a brief theoretical presentation, some useful data on types of events, numbers of died and displaced people, and economic loss that countries were faced are given to understand the importance of the subject.

The remainder of this chapter is structured as follows: following this introductory section, theoretical perspectives of migration which differentiate with respect to their focuses and how environmental migration could be embedded within these theoretical frameworks as a determinant will be discussed. I will then present what is climate change, what kind of natural disasters reported across the world and how they influenced human life. The next section briefly introduces numbers of individuals displaced due to natural disasters, together with an economic, politic, and social view to understand this type of human movement. Finally, this chapter ends with concluding remarks that highlights environmental migration is a fact and its interrelated and complicated nature.

2. A Theoretical Perspective on Environment-Induced Human Migration

Migration can be seen as a way to improve the lives of individuals. A large set of reasons may exist to shape migration decision of an individual. Migration theories, in this respect, provide a theoretical base to understand underlying forces of it. Amongst these theories, there exist micro and macro components of migration phenomenon since it is not an atomised micro-level issue or a result of pure macro-structural conditions (Doevenspeck, 2011).

Amongst these theories, neoclassical perspective takes migration as an individual decision making process where individuals are treated as rational actors that decide to migrate if net return is positive following a cost-benefit calculation (Massey et al., 1993). However, the new economics of labour migration (NELM) theory argues that migration decision is not necessarily made by individual migrant, but a group of people join in it together (Stark & Bloom, 1985). This behaviour helps to minimise the risk to group's (e.g. family's) well-being. In an environment where there is very limited or no insurance for crop against a future loss, this cause a family to get insufficient income (Massey et al., 1993) which could translate into a deprived living conditions for that family. Therefore, migration of a member of a family may decrease the impact of such risks by diversifying family income.

Environmental events such as flood, drought, landslide, or volcanic activities, particularly in less develop countries where insurance system does not function well, may necessitate a risk diversion behaviour. Afifi et al. (2016) analyse the relationship between rainfall variability, food insecurity and human mobility in Ghana, Tanzania, Guatemala, Peru, Bangladesh, India, Thailand and Vietnam where rainfall related climate issues such as floods, drought, seasonal shifts and dry spells have been widely experienced. Findings of their research showed that migration is a relatively successful adaptation strategy to reduce the risk on household livelihood; to maximize income (through remittances and migrant savings); to improve skills in some of case countries such as Vietnam, Thailand, and Peru. Although migration does not help to improve food security in cases such as Bangladesh, it generally seems to be an important strategy to cope with rainfall variability that induce economic and environmental risk on households. Moreover, some poor families in Malawi where food insecurity is an important concern in dry seasons send a family member to neighbour country Mozambique to seek work to supplement household income and to purchase food (Findlay, 2011).

Environmental events are not necessarily to be a direct reason for migration. Being highly dependent on nature which is not very predictable may bring about migration of individuals because of the fact that environmental distress limits opportunities for locals in the source area (Bylander, 2015). Accordingly, migration is perceived as a coping strategy for not only poor households but also for wealthy households as it provides a viable and low-risk alternative (Bylander, 2015).

It should be noted that not all of people who are affected by an extreme environmental event choose to migrate somewhere else. Migration decision is not a cost-free action, therefore, only those who can afford the cost may migrate. As highlighted by Black et al. (2013), such natural events are much more risky for poorer people as they are more vulnerable and less able to move. As seen aftermath of cyclone Aila in Bangladesh, families with insufficient social and financial capital could not undertake migration (long-distance, in particular) as the cost of migration was out of the budget of poor households (Kartiki, 2011).

Another aspect of such migration movements is whether it is a short term or a long term displacement. Decision to return following a disaster depends on several factors. Bryner et al. (2017) reviewed the literature on the individual decision to relocate or return home following Hurricane Katrina and Super storm Sandy in 2012 in the US. This study presents five major factors that affect individuals' decision over remaining, relocating, or returning, that are habitability of homes; access to affordable housing; financial burdens associated with moving back or rebuilding; restoration of and access to public services and facilities; and sense of place and identity. Authors also mentioned that concerns over possibility of future disasters, rebuilding and recovery processes, and loss of employment influence affected people's decision.

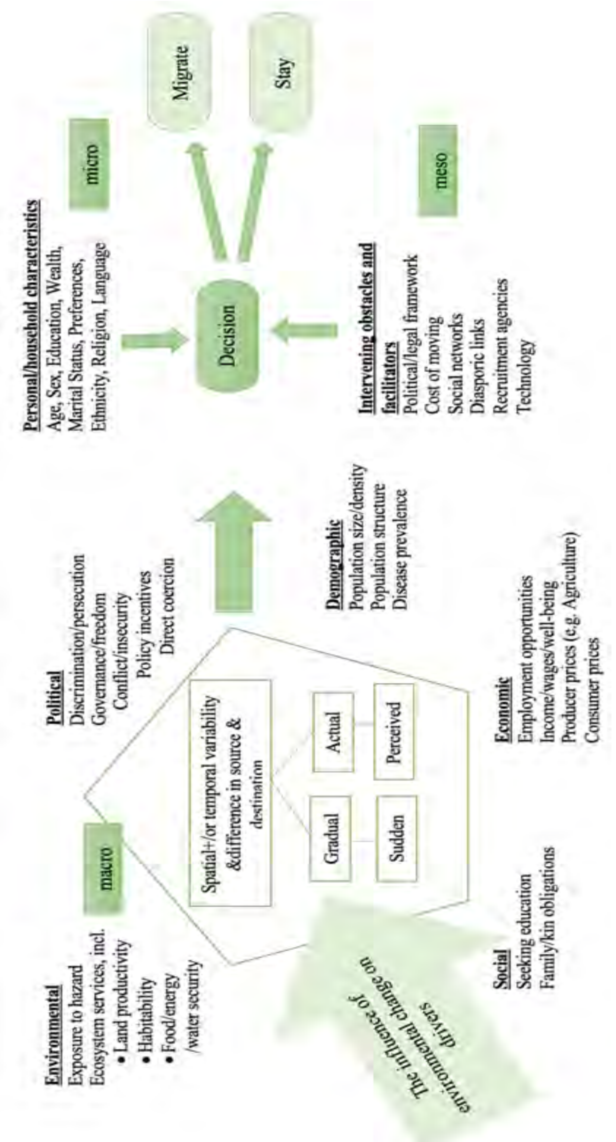
Vulnerability of individuals in developing countries due to lack of necessary and preventive measures such as insurance systems, financial reserves to be used after an event, education and training to warn people about potential disasters and what to do, and so on may well interact with other factors that end up with migration decision of individuals. In this respect, two major interconnected arguments arise, that are the weight of environmental/climatic factors in migration, and the connection among other push or pull factors such as a social, political, or economic nature (Piguet et al., 2011).

Broadly speaking, migration theories focuses on wage/income differentials and labour markets, and migration is seen as an equalising process. However, environmental deterioration has not deeply explained by current theoretical perspectives. Environment-induced migration decision combines several personal and structural considerations, therefore, it necessitates both micro and macro approaches for a better understanding on the determinants and results of this sort of population movements.

Black et al. (2011) developed a migration drivers framework that influence volume, direction and frequency of migratory movements, together with the different levels of analysis (i.e. macro, micro, and meso). As presented in Figure 1 below, their study revealed four components migration as follows:

- A distinction between types of migration, instead of types of migrant
- the identification of five primary of drivers of migration with the recognition of actual or perceived differences across space in these drivers
- the role of agency on how drivers translate into outcomes, together with the representation of barriers and facilitators to migration
- environmental change to be incorporated as a direct effect on migration as a result of changes to environmental drivers, and also as an indirect effect as a result of changes to the other four drivers.

Figure 1: Black et al. (2011)'s Conceptual Framework for the Drivers of Migration



Note: From Black, R., Adger, W. N., Arnell, N. W., Dercon, S., Geddes, A., & Thomas, D. (2011). The effect of environmental change on human migration. Global Environmental Change, 21, S5 (https://doi.org/https://doi.org/10.1016/j.gloenvcha.2011.10.001)

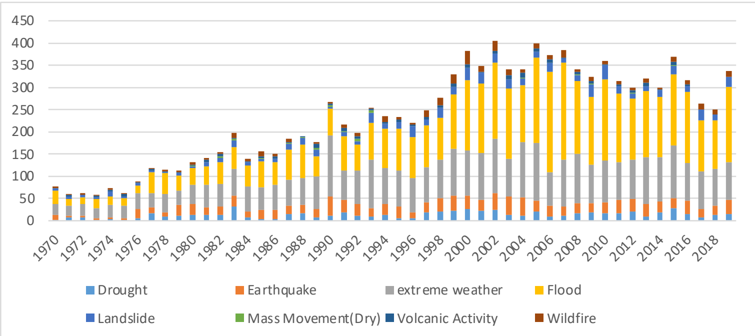
3. Climate Change, Deteriorated Environment, and People on the Move

Non-renewable resources such as oil, coal and minerals have long been used by humanity in an unsustainable level, along with the fact that renewable natural resources such as soil nutrients, rainfall, climate and others have been exploited more than earth's capacity (Bodvarsson & Van den Berg, 2013). This overuse of resources on earth has some side effects on both human being and the rest of the ecosystem.

Technological improvements in several sectors have made human life easier. More amount and variety of goods and services have become producible in a shorter time span and purchasable at much lower monetary cost through large scale capital-intensive production methods. One example of this is observed in agricultural sector. Monoculture is a growing agricultural practice across the world that is based on production of a single crop on the same land repeatedly instead of crop rotation that is based on alternation of different crops on the same land. Synthetic fertilizers and pesticides, replacement of animals to machines, and improved variation in crop have motivated farmers in US to choose monoculture instead of rotation (Bullock, 1992). This type of production has negative side effect on land, as well as spreading effect on the environment. Using high chemical inputs in monoculture cropping jeopardise biodiversity (Bavec & Bavec, 2015; Leteinturier et al., 2006). It also increases soil erosion, pollution of water, and emission of greenhouse gases that contributes climate change (Popescu Slaikova, 2019).

Human activities such as burning fossil fuels, deforestation, industrial and agricultural practices have contributed the increment of greenhouse gases since 1800 (Schneider & Lane, 2006) that has altered climate on earth. Climate change across the globe has given rise to extreme natural disasters through unusual temperatures, more often stronger cyclones and hurricanes, droughts and floods, and other disturbances that affect many lives. According to *Centre for Research on the Epidemiology of Disasters' (CRED) Emergency Events Database (EM-DAT)*, from 2000 to 2021 1,364,735 people died because of natural disasters across the world. CRED also reports that global occurrences of natural disasters has considerably increased since 2000. Although climate can change due to natural reasons, it has mainly changed as a result of detrimental human activity since 1800s, such as burning fossil fuels that generates greenhouse gas emissions (UN, n.d.). Thereby, occurrences of disasters like drought, ice loss, fires, scarcity of water, and storms have remarkably increased because of overheated planet earth.

Figure 2: Global Reported Natural Disasters by Type



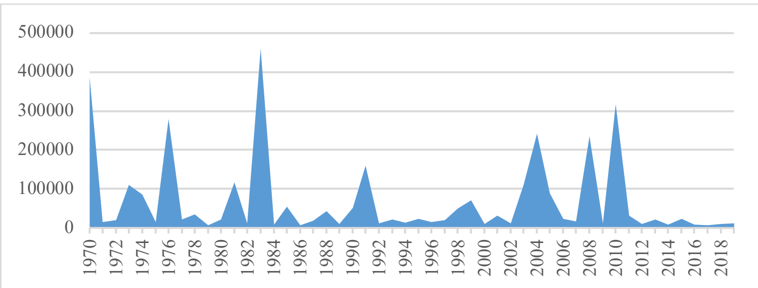
Source: EMDAT (2020): OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium OurWorldInData.org/natural-disasters

Figure 2 shows annual reported types of natural disasters from 1970 to 2019. It is seen that flood has been the most reported disaster since early 1990s, while it does not seem to happen that often in 1970s. Especially Asia and America have seen devastating flood disasters. Eighty per cent of Bangladesh with the highest record of flood in 1988; millions of people in China in 1991; highest recorded level of water rise in Mississippi and Missouri rivers in the second half of 1990s in US; floods and following landslides with 30000 deaths in Venezuela in 1999; and floods in Mozambique with more than half a million homeless in early 2000s (Houghton, 2006) were some flood cases across the world.

Extreme weather conditions constitute second largest natural disaster over years. It is used to describe the events of hurricanes, typhoons, cyclones and tornadoes (Ritchie & Roser, 2014) which seem to increase over years. While a part of the world has been dealing with floods/water-related disasters, another part such as Africa has been suffering from intense drought. Even if floods and extreme weather events were the most reported natural events, other types of disasters such as earthquakes, wildfires, landslides etc. have also been experienced in an increased level. The number of reported natural disasters has consistently exceeded the amount of 200 since 1990.

Environmental conditions, especially due to climate change related disasters may directly hit individuals' living conditions. Landslides as a result of heavy rain, for example, can directly affect households as experienced by in the city of Manizales/ Colombia. This disaster killed at least 17 people, along with seven missing, destroyed houses, and suspended water/electricity/gas services in Manizales (BBC, 2017). This is only one case and considering there are many cases across the world, severity of consequences becomes clearer. A broader picture of the number of people who died due to natural disasters was reported by EMDAT and presented in Figure 3 below for the years from 1970 to 2019. It's seen that the highest number of deaths was recorded in 1983 with more than 460 thousand people. Famine and drought in Ethiopia in 1983-85 (Ritchie & Roser, 2014); earthquake in Turkey, Columbia and Japan; floods in Peru and Ecuador; winter gales in US (Berz, 1988); and storm surges in Bangladesh (Murty, 1988) were major event occurred in 1983. After this year, natural disasters seem to be less fatal, although the first decade of 2000s witnessed a wide range of deaths. Number of deaths due to natural disasters has decreased considerably since 2012.

Figure 3: Number of Deaths from All Natural Disasters



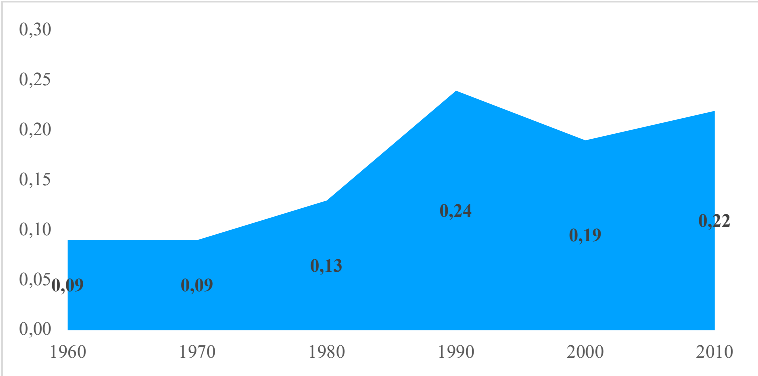
Source: EMDAT (2020): OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium OurWorldInData.org/natural-disasters

Although human health can directly be affected by such hazards, it is also likely to be affected indirectly. Bambrick et al. (2008) examined the impact of climate change on health and argue that there are indirect pathways through disruption of natural ecological systems such as changes in spores and pollens that entailing more asthma and other allergic respiratory diseases. Besides, temperature anomalies are major challenge of climate change that disturb the ecosystem. Intense fire events, as a result, give rise to higher global carbon emissions and influence air quality (Keywood et al., 2013). Either direct or indirect effects of natural extreme events contribute worsening health and living conditions. Eventually, these disturbances and anomalies sometimes result in human migration.

Movements of human beings within and across national borders has been widely discussed from several aspects. These movements can be the result of various reasons and people who are involved in it are generally classified based on these reasons to make them move such as economic migrant, forced migrant, or environmental migrant. This chapter, however, focuses on environmental migrants that are defined, in Migration, Environment and Climate Change: Evidence for Policy (MECLEP) glossary, as "… *persons or groups of persons who, predominantly for reasons of sudden or progressive change in the environment that adversely affects their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad.*" (p. 13). This definition clearly states that these migrants are pushed out of their source area due to environmental conditions; they may cross national borders or not; and they are not always supposed to return back to their source area. These characteristics of this type of migrants are likely to have important implications in terms of the effect on the source and destination areas. In this sense, economic and political approaches become important.

Natural disasters cause an economic loss depending on the scale of disasters for countries. Ritchie and Roser (2014) presented economic damages from disasters across countries over years as shown in Figure 4. According to their calculation, world average of economic damages from disasters that include all geophysical, meteorological and climate events including earthquakes, volcanic activity, landslides, drought, wildfires, storms, and flooding increased from 1960 to 2010 as a share of GDP. While economic damage was 0.09 per cent of GDP in 1960, it increased to 0.22 percent of GDP in 2010. This means natural disasters became costlier for economies. Financial management of disaster-related risks is a crucial public policy challenge for governments (OECD, 2021). High-coverage insurance system might be a necessary tool to alleviate natural disaster-related risk either on households or businesses. As mentioned in NELM, insurance system is very important to protect household income and lack of this system can give rise to migration of a family member to sustain that income. More than half of economic losses due to earthquakes, floods, storms and wildfires were uninsured between 1990 and 2019 in OECD countries, and insurance coverage varies across countries significantly (OECD, 2021).

Figure 4: Total Economic Damages as a Share of GDP, %, World

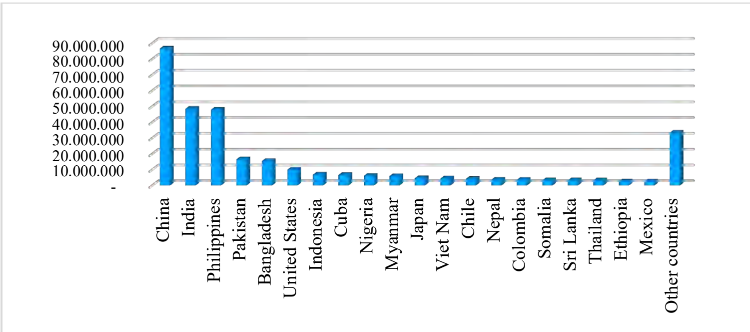


Source: Ritchie & Roser (2014)

Disasters are more likely to affect poor households. According to Morrow (1999), poor people are less likely to have financial reserves that would help buying services aftermath of a disaster; more likely to have poorly built housing that is less resistant in the case of a disaster; more likely to have low-paid jobs that are lost after a disaster. This situation makes poor households more vulnerable than rest of communities.

The economy is in a complex interaction with human society and that society in an interaction with natural environment (Bodvarsson & Van den Berg, 2013). This complicated nature of their relationship is reflected by the difficulty of explaining economic problems and suggesting appropriate policies. Nevertheless, the reality of climate change seems a direct challenge to maintain a sustainable relation amongst those parties. Climate change is mostly due to human action and it can exacerbate natural disasters such as extreme weather events, floods, droughts, etc. To understand how it influence human society, the numbers of natural disaster- related displaced individuals might be useful to see. The Internal Displacement Monitoring Centre (IDMC) provides data on internal displacements due to either conflict and violence or disasters across the world. Figure 5 shows top 20 countries in terms of total number of displaced between 2008-2020. Accordingly, China had the highest level of displacements due to disasters with more than 86 million people over years. Almost half of the number of people displaced in India and Philippines in comparison with China. Most of displacements occurred in Asian countries, with few exceptions of Americas and African countries.

Figure 5: New Displacements between 2008-2020, Disasters



Source: IDMC (2020)

The size of the group of affected people from natural disasters in a country brings to mind that how much resistant these countries are, or, vulnerability of countries to negative effects of climate change. This is crucial from economic and political perspectives, as well as from social perspective. Climate change induced migration of people might be driven by both climate-related factors such as sea level rise and non-climate-related factors such as local resilience to natural disaster, government policies, or population growth that all together contributes to relatively more vulnerable people in particular (Brown, 2007). That vulnerability of communities might be reduced through more measures to avoid its adverse effects (Kelman, 2019). Thereby, climate change induced human migration is, to a large extent, connected to local or national investments and measures that can influence preferences of individuals to move or not to move.

Environmental migrants might be represented in different ways. Ransan-Cooper et al. (2015) introduced four different framing of environmental migrants, that are environmental migrants as victims; environmental migrants as security threats; environmental migrants as adaptive agents; and environmental migrants as political subjects. This differentiation matters on the way in which environmental migrants are understood and what kind of policies to be implemented. Individuals who experienced climate change –induced migration may contribute social disorder where they migrated into. Koubi et al. (2021) investigates whether climate change-induced migrants would be willing to join and participate in social movements in three cities in Kenya with more than 2,400 migrants. They found that if migrants experienced both sudden and gradual climate related events in their previous homes, they are more likely to protests –even if it can be violent-, and join social movements to claim their rights. Grievances of these migrants are likely to influence their behaviour that might raise concerns over social disorders in migrant-hosting societies.

4. Conclusion

Intense carbon emissions due to burning fossil fuels cause rising temperatures that severely affect water, land and weather patterns across the globe. Climate change as a result of disruptive human activities has a variety of consequences. Increased frequency and intensity of natural disaster events are one of the biggest challenge for countries. As a result of this, environmentally induced migration seems to be a way of avoiding adverse effects of natural disasters as an adaptation strategy for households.

Migration behaviour of human being has widely been discussed either in a theoretical framework or in an empirical investigation. Migration theories vary depending on underlying forces of it. From micro perspective, neoclassical migration theory focuses on individuals and it argues that migration decision of an individual depends on positive net return from migration based on cost-benefit calculations. This approach was criticized by the new economics of labour migration (NELM) theory, saying that migration decision is not always an individual decision as it is sometimes a joint decision to help minimising the risk to family's well-being. The higher likelihood of exposing risk on household income –so, higher deprivation of living conditions, the higher likelihood of migration of a family member to decrease the impact of such risks by diversifying family income. Hence, family characteristics might be very important for migration decision of an individual.

As seen from current patterns of environmental migration across the world, they are several economic, political, demographic, social and environmental drivers are intersecting together which are not easy to decompose. The interaction of several factors is key to understand insights into decision making process of migrants. In some of the cases, existence of environmental, economic, or political drivers, for example, may not necessarily end up with migration of an individual. Individual and household characteristics, along with other elements that surround decision making process might step in, and final decision might be staying in rather than migrating out. Even if migration takes place, there are still other decisions to make, whether it is temporary, or permanent; national, or international.

Last but not least, whilst the chapter provides an overview of the climate change and related human migration as a consequence of disruption of environment, it is important to connect research with appropriate policies.

It is obvious that either national or international authorities should recognise that environmental change is an important driver of migration, and environmental migration should be conceptualised in a legal framework that could protect human rights in such cases. First, disruption of ecological systems must be prevented to ensure a stable ecosystem. Governments, in the meantime, need to take risk-minimiser measures that could protect households from potential disruptive effects of natural hazards at local level. Moreover, multilateral agreements to manage potential flows between neighbour countries, in particular, might be useful in an extreme event that pushes hundreds of people away as seen in Africa, for example.

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Rethinking Sustainability and Growth in the Anthropocene

Hikmet Gülçin Beken (Gumushane University)
ORCID: 0000-0002-1664-456X
hgulcin.beken@gumushane.edu.tr

Abstract

The goal of the economic development is reached as a result of the higher usage of production inputs on qualitative and quantitative levels, and this situation brings the issue of environmental protection to a more debatable point, especially for future generations. Environment-related problems should be evaluated on a global level, and they should be discussed by keeping in mind the fact that they are in an interaction with each other. Increasing the living standards of individuals by considering the limits of the planets and integrating these limits with the social limits has given rise to discussions over the concept of doughnut economics for the 21st century. In this context, this study discusses environmental problems under the framework of the main emphases and theses of sustainable development and doughnut economics, and beyond economic development.

Keywords: Sustainability, Circular Economy, Growth, Development, Doughnut Economics

JEL Codes: Q01, O10, O44, Q57

1. Introduction

The current era is a period where the existence and effects of problems originating from climate change and global warming are more noticeable and worrisome at some point. The intensity and severity of ecological crises have a challenge for individuals to face. Environmental problems put at risk the lives of both current and future generations on the national, international, and global scale. Therefore, it is crucial to evaluate the problems efficiently and to find the solutions by taking into account the trade-offs between economic growth and environmental issues.

When environmental problems are evaluated through the system approach[1], it is discerned that changes experienced in the environment are, in a complicated fashion, interrelated to other societal crises, risks, and vulnerabilities. In the presence of such an interrelationship, for instance, should the priority be to solve poverty and inequality problems or to find a solution to problems stemming from environmental issues (climate change, deforestation, ozone layer depletion, and so on)? The answer to these questions differs at national, regional, and global levels. Especially when global sustainability is considered in terms of energy production and consumption, the necessity of societal transformation should be highlighted. Such a societal transformation requires the participation of each actor, the effective use of information and technology, and the assumption of joint responsibility for policies and actions at national and global levels, in other words, societal transformation necessitates the significant alteration of socio-ecological systems (Hackman and Moser, 2013).

As a comprehensive approach, system integration makes it easier to deal with various aspects of systems belonging to humanity and nature (socio-ecological and human-environment relationships), examine their complex interdependencies in a more appropriate way, and produce solutions that will support sustainability. A system-based point of view will especially lead to the emergence of strategies and policies that will support the achievement of sustainability on a global level (Liu et al. 2015).

What should be understood from climate change is important, and regardless of whether it is addressed from a social, economic, or political perspective, certain uncertainties and obstacles come out about what sort of a problem climate change refers to. For instance, greenhouse gas emissions can be produced as a consequence of almost every kind of human activity or the majority of economies are highly dependent on fossil fuels. In this situation, what should be the responsibilities of countries that produce greenhouse gas emissions at considerable amounts? In answering this question and other similar questions, the first step to be taken is to accurately identify what sort of a problem climate change is. From a certain perspective, this is a hard decision, and from another perspective, it is also a political decision as answers that focus on different costs and benefits for different groups are political by nature (Hoffmann, 2013).

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1 What is meant by the system approach is to take a holistic look at the ecosystem and environment and their interrelationship specifically through all sub-systems. With an interdisciplinary approach, the system approach addresses environmental problems through their dynamic and interdependent sophisticated structures, rather than through a linear structure (Petak, 1981; Kass, 2019).

Climate policies are usually designed by focusing on climate-related strategies (pricing policies, regulations and norms, supporting green technologies and innovation). However, as much as these instruments and strategies, the support of the decarbonization of the economic system in economic development and fighting poverty is also required for a successful outcome (Fay et al., 2015:20). For countries that are dedicated to fighting global warming with their goal of zero (net) emissions, it will not be sufficient to only focus on reducing carbon emissions in the achievement of this aim. At this point, thinking of not only the natural system of the world but also the economic system as a whole with the circular economy approach will provide greater support in the way to a solution to problems such as climate change, drought, floods, erosion, and loss of biodiversity (Ishii, 2021).

Today, there exists an era of economic growth that is shaped by global inequalities and poverty. According to the World Bank (2020:27), with the added influence of COVID-19, it is expected for 88-115 million people to fall into extreme poverty by 2020. However, it should not be forgotten that climate change is also among other factors that are influential on poverty. It is expected that 68-132 million people will fall into poverty by 2030 due to the accumulating effects of climate change. Four in every five people living under the global poverty threshold live in rural areas, and 132 million global poor live in regions with a high risk of overflows/flooding. People who are facing several risks that can be caused by climate change consist mainly of the poorest groups.

It is estimated for the world's population to reach approximately 10 billion in 2050. Can the existing consumption and production patterns provide sufficient resources for such a large population? Or, with the increase in emission volumes considering again the existing consumption and production structures, will it be possible to overcome environmental pressures? At this point, among climate policies, transition to renewable energy[2] or adopting the circular economy model is among the most prevalently preferred strategies (van Veldhoven and Schmidt, 2021).

2 Renewable energy sources and policies can help countries to reduce greenhouse gas emissions and to support their sustainable development goals (Uğurlu, 2019; Dinçer, 2000) but the planning and implementation of this energy (Spillias et.al, 2020) might also undesired outcomes for environment and sustainability. It should be kept in mind that there might be a trade-off between these goals.

Circular economy is explained as a philosophy about minimizing environmental effects/loads by reducing the demand for energy and raw materials and increasing the output and operations (Bimpizas-Pinis, 2021; Moreau et al., 2017). Circular economy aims to disrupt off-the-self and throw-away consumption and production patterns and ensure that products, components and materials are used with the highest utility and value in the process from production to consumption. It is an approach about the more effective utilization of resources through methods such as reuse, refabrication, renewal, and recycling (Bocken et al., 2017).

Practices associated with circular economy can be carried out on a level of individuals, firms, or countries. Strategies like reshaping consumption (associated with the value chain and demand), redesigning products (especially in a way to make recycling easier) and transforming the heavy industries may be adopted. In summary, circular economy is encountered at every stage of the product that can be found in the value chain including the product's design, its use, raw material supply, recycling, and waste management (Ishii, 2021).

Circular economy strategies provide economic opportunities, social and environmental benefits as much as reducing greenhouse gas emissions does. They not only lower the costs of people's access to goods and services but also increase resilience against the physical effects of climate change (such as the ability to separate economic activities from raw materials that are susceptible to the climate crisis) (Ellen MacArthur Foundation, 2021).

Circular economy can be seen as a way of gathering planetary boundaries and economic models in sustainability by promoting SDGs and sustainable development (NEA/HCH/NL, 2020; Berg et.al, 2018). In essence, circular economy supports the achievement of sustainable development goals. It has effects like increased air quality, protecting biodiversity, and reducing water pollution. In the fight against climate change, it is observed that in general, firms and countries prefer to focus on renewable energy resources and energy efficiency. Nevertheless, while these are among strategies that are compatible with circular economy, only 55% of greenhouse gas emissions can be reached with these methods. In its essence, circular economy accomplishes the reduction of emissions by transforming the production and use methods of products (Ellen MacArthur Foundation, 2021).

2. Growth, Development and Sustainable Development: Some Controversial Issues

The concept of development should be discussed with a combination of both economic and non-economic factors. In addition to an improvement that can only be seen in economic conditions, it should also include an improvement in all areas of an individual's life (Doğaner-Gönel, 2013:5). The main focus is to ensure a decent living standard that befits human dignity and increase social welfare without any discrimination in the society (Toksöz, 2011). Expanding the basic freedoms of an individual also means a struggle against all kinds of conditions and factors that confront them with poverty, inequality, and deprivation, and that limit their basic abilities (Sen, 2004).

In the 1950s and 1960s, the concept of development, which was considered synonymous with growth policies and focused on quantitative changes rather than qualitative changes in economic performance, turned into a concept that aims to achieve justice in income distribution, fight against poverty, improve the quality of institutions and protect the environment in a more inclusive and deeper context throughout the period that reaches today (Aysan and Dumludağ, 2014; Rabie, 2016). While economic growth is the expression of an increase in the production rate or income of a society, development is about the social, political and institutional changes and transformations that take place in that society (Doğaner-Gönel, 2013:10). In a successful development process, it is observed in the relevant society that an increase in industrialization and decrease in the share of agricultural sector in the output, a change in the trade structure (products with more added value, etc.), production relying on know-how and human capital more, and basic institutional transformations are realized (Cypher and Dietz, 2009:21).

While evaluating the performances of countries in terms of economic growth and development, GDP, GNP or their per capita values are used as the most common criteria. However, these indicators bring along some limitations in measuring economic activities and welfare. A measurement based on GNP or GDP, no matter which indicator is chosen, may be inadequate in terms of solving problems stemming from economic growth due to its focus on output growth. The most important problems are regarding the following: the elimination of the effect of inflation (inclusion of products in the price index with a correct weighting, the share of public services and the private sector in the economic structure, etc.) and reflecting the changes in product quality and diversity (especially due to innovation) (The Economist, 2016). Excluding domestic work (child and elderly care) and ignoring the positive and negative effects of economic activities on the environment[3] (such as pollution and erosion) should also be included in the areas where economic development and social welfare are lacking (Rohner, 2018).

As Lepenies (2016) and Stiglitz (2009) stated regarding alternatives to GDP, the answer to the question of what kind of society we would like to live in will be decisive. In this age, when the effects of climate change are encountered more frequently, methods that try to realize and assess an economic structure in which incomes and wages can be distributed more fairly may be good alternatives. In other words, sustainability and social welfare and well-being need to be more accurately correlated and included in analysis. What should not be forgotten here is that it has become inevitable for today's economies that the trade-off between the protection of environment and increase in output is more traceable.

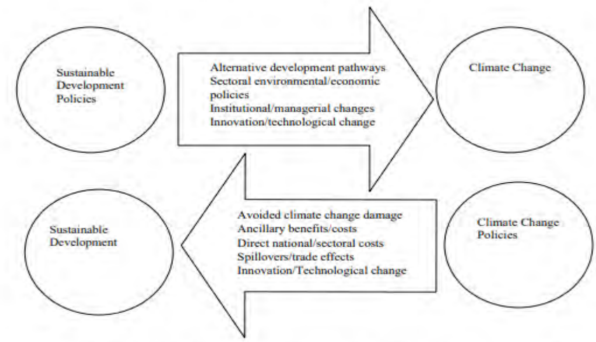
On the subject of sustainable development, which is a multidimensional concept, the interrelationship between environment and development is highlighted by the Brundtland Report, dealing with the relationship of environmental pressures with each other and the relationship between environmental pressure and the type of economic development under the assumption that they are all related to many social and political factors. The emphasis is on meeting the needs of current generations without compromising future generations' ability to meet their needs. One remarkable point is both emphasizing the basic needs at the individual/societal level and highlighting the fact that the environment is somewhat restrictive on the capacity to meet these needs. For this reason, it is emphasized that the goals regarding economic and social development must be handled and defined in the context of sustainability (UN-WCED, 1987).

Griggs et al. (2013) defines sustainable development in the Anthropocene era as meeting the needs of the current generation while preserving the life-supporting systems of the world on which the well-being of both current and future generations depends. Considering this definition, at the time what needs to be done regarding the development of individuals (end poverty, universal education and health, gender equality, environmental sustainability, global cooperation) and the sustainability of the planet's existence (clean air, biodiversity, resource use, nutrient cycle, hydrological

3 A variety of views come out about environmental constraints imposed on economic growth. In this respect, three common views come to the fore, that is, the economic growth being unlimited, the decelerating effect of environmental factors on growth, and lastly, the economic growth not continuing ad infinitum (Hepburn and Bowen, 2012).

cycle, ecosystem services) are fulfilled, the sustainable development goals in line with the new definition will also be realized.

Figure1: The Linkages Between Climate Change/(Policies) and Sustainable Development/(Policies)



Source: Swart et al., 2003.

The strong relationship between climate change and sustainable development can also be observed in the Figure 1. When considered in terms of climate change, the conditions that cause it and its effects are closely related to the three basic dimensions - economic, environmental and social - that make up sustainable development. Policies to be followed in both areas should be created in a way that they take into account this mutual relationship and interaction (Swart et al., 2003). At this point, Robinson et al. (2006) emphasize that sustainable development can offer climate policy goals that are more efficient than climate policies themselves (on the one hand, providing a lower level of carbon emissions and a sustainable future, on the other hand, climatic goals emerge as a by-product). The IPCC (2007) study also highlights the dual relationship between sustainable development and climate change. The impact of climate change on the living conditions of individuals and nature will affect social and economic development, and a society's priorities regarding sustainable development will actually affect indicators such as greenhouse gas emissions that cause climate change, risks and vulnerabilities in these areas.

Sustainable development actually tries to achieve three main goals such as economic, social and ecological development, all together at the same time. Stricter definitions of sustainable development, on the other hand, claim that there is a hierarchy between these goals and therefore ecological and social ones should be given priority (Rashid, 2020). 17 sustainable development goals[4] and 169 objectives that elaborate these, adopted under the umbrella of "The 2030 Agenda for Sustainable Development"[5], which make development goals of the millennium move further forward, emphasize the inevitability of achieving a balance in all these three economic, social and ecological layers of these priorities, which are integrated and inseparable in terms of our planet, our people and our well-being. Objectives related to the existence of humanity and the planet, peace, cooperation and common welfare have been put forward (UN, 2015b).

The existence of sustainable development goals is actually an expression of a transition from treating poverty and underdevelopment as separate phenomena from environmental problems to accepting that these two are closely related. When sustainable development goals are considered at the integrated level, it should not be forgotten that the goals on an individual basis would create effects that may conflict with each other (energy supply and combating climate change). It is necessary to point out the two points at which the sustainable development goals conflict. These consist of a combination of goals emphasizing the necessity of economic growth for human development as well as goals for the protection of the planet on the basis of harmony with nature (Hickel, 2019:874; Griggs et al., 2013).

3. How Did the Concept of Doughnut Economics Emerge?

Doughnut economics can actually be considered as a solution for ensuring social welfare and economic development together in the era of social inequalities and environmental degradation/pollution. It offers important suggestions on how the 21st century can be planned with an alternative to mainstream economic thought (providing social welfare, realizing the goal of economic growth, and protecting the environment). It investigates the existing economic rules and operations through the dynamics of the capitalist system and its transformation into a structure where wealth is distributed instead of being growth-oriented and ecosystems can reproduce themselves (Ceil, 2018).

Doughnut economics in the Anthropocene emerges as an important roadmap for the twenty-first century and a method that supports the

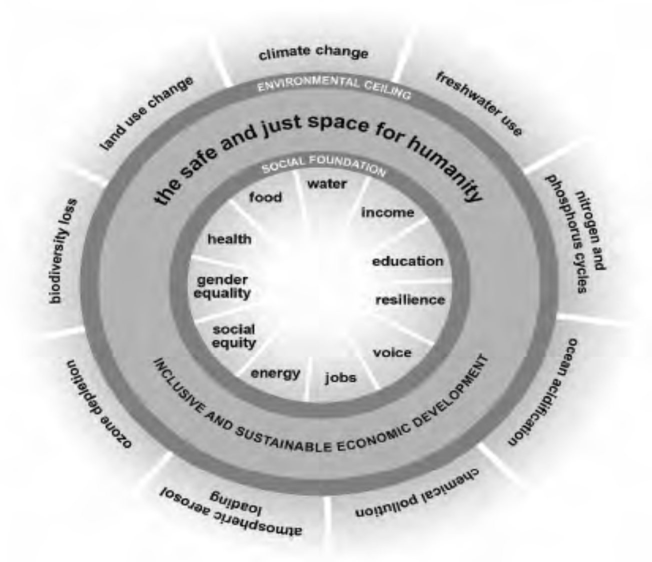
4For more detailed information on the eight global goals planned to be achieved by 2015, determined at the United Nations Millennium Summit in 2000, the United Nations (2015a) can be examined.
5When evaluated in the context of the relationship between human development and sustainable development goals, in addition to the integrated and inseparable structure of sustainable development goals, it is emphasized that each country can prioritize these goals according to their own situation (flexibility), differing in two basic points (Conceição, 2019).

restructuring of economic and political decision-making processes, with its structure emphasizing that the well-being of people depends on the well-being of the planet and revealing the severity of inequalities within and between countries arising from current social and environmental conditions (Raworth, 2017a). According to Stopper et al. (2016), Doughnut economics, which is one of the modern models in terms of sustainability or sustainable development [6] , actually divides global interactions and interdependencies into smaller ecological and social parts that can be easily acknowledged, and thus facilitates the recognition of the boundaries that a sustainable economic system encounters through various parameters.

The emphasis of the doughnut economics is actually a proof that in the 21st century, there is still the opportunity to achieve sustainable development goals on one hand and strategies and mechanisms to reduce emissions at the global level on the other. The doughnut economics is an example of a closed system limited to both basic human rights and environmental sustainability. The area between the environmental ceiling and the social foundations represents the livable, safe and fair area for humanity (the area/space where inclusive and sustainable development will be achieved). The existence of this area is an expression that the well-being of both humanity and the planet is achieved, and that their interdependencies are taken into account. The environmental ceiling highlights a point that should not be crossed by us, namely, the boundaries of the planet (climate change, freshwater use, nitrogen and phosphorus cycles, ocean acidification, chemical pollution, ozone depletion, aerosol condensation in the atmosphere, biodiversity loss, land use). Similarly, it is possible to encounter serious deprivations at a point below the social foundations. In the context of human rights, a limit is drawn that no one living in the society should fall under. With the existence of twelve basic areas such as access to energy and clean water, food safety, health, education, income and employment, peace and justice, participation in social decisions and being able to be heard, social justice, gender equality, housing and shelter, and social networks, basic social standards that the individuals have self-respect and are able to access opportunities are achieved (Raworth, 2012).

6The author preferred to use these two concepts as synonyms. However, the studies by Morelli (2011) and Sutton (2004) can be examined for different definitions and highlights of sustainability.

Graph 1: The Doughnut of Social and Planetary Boundaries



Source: Raworth, (2017b,218).

Raworth (2017b) discusses the sustainability of human activities within the concept of social and planetary boundaries without threatening the world's self-sustaining vital systems. In this holistic approach, methods such as going beyond the measurement of GDP and adopting the doughnut economy (aiming not an endless growth, but a balanced growth), taking into account the relationship and dependency between the economy-society-state instead of the priority and superiority of the market, the existence of more distributional economies in terms of wealth and income inequalities, the adoption of a circular economy, and the creation of a production structure that will protect the environment are emphasized.

During the Holocene, environmental changes naturally and the regenerative capacity of the earth created conditions that allowed human development. In order to at least provide the situation in the Holocene epoch, the planetary boundaries approach has been suggested by scientists. The boundaries of the planet are actually the definition of boundaries for humanity that respect the world system and define a field of study/operation associated with the world's biophysical processes and subsystems. In this context, Rockström et al. (2009)[7] tried to determine

7In the study by Steffen et al. (2015), some of these nine indicators representing the world system remained the same, while others changed. Definitions such as biosphere integrity instead of biodiversity loss rate, fresh water use instead of global fresh water use, novel nine processes (climate change, biodiversity loss rate, nitrogen cycle, phosphorus cycle, ozone depletion, ocean acidification, global freshwater use, change in land use, atmospheric aerosol density, chemical pollution) that may lead to unacceptable environmental changes if not prevented and parameters to measure them. It was emphasized that many of these boundaries are related to each other, and that parameters exceeded in one of them will have important consequences for the others.

The concept of planetary boundaries is the expression of a scientific analysis that allows us to assess the extent and degree of human interventions to the risk that the earth system could be destabilized on a planetary scale. Human activities jeopardize the resilience of the world's self-functioning system and adversely affect its capacity/ability to withstand these pressures and shocks. The current condition or violation of boundaries has actually emerged as a result of the actions of many different societies and groups, and the results have been undertaken unequally. From this point of view, the planetary boundaries approach cannot state how to act within a robust functioning/activity area related to sustainability at the global level. It should not be forgotten that political decisions are also binding here (Steffen et.al, 2015).

The planetary boundaries approach endeavors to avoid surpassing biophysical and biological thresholds. However, it should also be borne in mind that what the acceptable risk is (the identification of the threshold value) determined on the basis of certain basic judgments. The designation of policies and mechanisms that allow human beings to stay in a safe and equitable area means that different actors and their values and interests are included in the process and winners/losers, risks, and opportunities are diversified. This, in turn, shows us that some of the ways selected for the fulfillment of targets can be both compatible and incompatible with each other and can include significant trade-offs (Leach, Raworth, and Röckstrom, 2013).

The Figure 2 shows the absolute and per capita carbon dioxide emissions in 2015 based on income groups. The relatively high levels of the contributions of those in the top 1% and 10% income groups to the total carbon emission values can be seen graphically. The richest 1% of the global population produces more than two times the total emission volume produced by the poorest 50%. While discussing the limits of the planet, an emphasis may be made on the excessive resource usage and consumption of the wealthiest proportion of society using these values.

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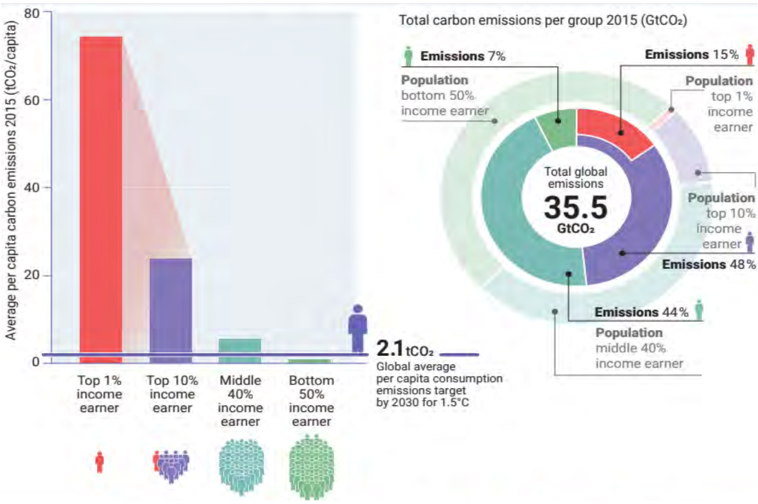
entity instead of chemical pollution, biogechemical flow instead of individual definitions such as phosphorus and nitrogen cycles have been adopted.

Figure 2: Per capita and absolute CO2 consumption emissions by four global income groups (2015)



Source: UNEP, 2020:25.

An important challenge to the applicability of the planetary boundaries approach is due to its impact on national policy-making and international negotiations. Although climate change is a very serious problem that requires global governance, the level reached or crossed at the local and regional level, especially in terms of fresh water and land use, may adversely affect the reaching of an international agreement on this issue (Raworth, 2012).

Regarding the limits of the planet and the ecological limits emphasized in this context, by the year 2009, thresholds in the three main systems (losses of biodiversity, climate change nitrogen cycle) have been exceeded. The issue that needs to be kept in mind when setting ecological and social limits is the fact that they are interrelated, and the effects of exceeding the thresholds of one of them on the other indicators have not been completely understood. It is uncertain when a dangerous level of environmental damage or the deterioration of the self-renewal capacity of the earth will occur, and when sub-systems will begin to operate once again within a safe range (Rockström et al. 2009).

The limits of the planet approach is subject to criticism from some perspectives. How the limits are set, as well as which values pose a risk, is an issue that is shaped based on existing judgments. While there are no decidedly clear definitions, there are gaps in this approach due to the use of definitions that occasionally contradict each other and as it does not deal with these indicators in a functional sense (Montoya et al., 2018). In general, it attracts criticism from development theoreticians, scientists and world-system perspective. As the limits of the planet perspective has a restrictive effect on the development process and economic growth, it has not received adequate support from the Global South (countries that have not completed their development process yet). Moreover, additionally, as limits are considered globally in this approach, it does not involve concerns about international inequalities and social justice (Biermann and Kim, 2020).

4. Green Growth Strategies (Policies)

Green growth means that, without having any decrease in the total natural capital, economic activities increase in the short term and particularly in the long term. The growth part of the concept generally refers to the GDP while its green part pertains to the protection of the value of the total natural capital. Upon the review of green growth definitions, it is discerned that they are closely related to the concept of sustainable economic development[8]. On the other hand, green growth refers to a wider concept to include the use of natural resources and environmental effects in a way to transcend targets such as achieving low carbon emissions or reducing climate change (Bowen and Hepburn, 2014).

Just as sustainable economic development, green growth is as well in an effort to show that the environment is not protected at the expense of welfare and prosperity. Green growth suggests that the protection of the environment just as the compatible relationship between environment and economic growth will bring about a better economic growth performance. The green growth theory states that the cost of fighting the environmental damage is not too high at all when the natural growth rate of an economy that performs well falls to zero. If the environmental damage cannot be eliminated, the cost of a worsening environment will be even higher (Jacobs, 2013).

Green growth refers, in its most general sense, to the transformation of present production and consumption models at the global scale. Policies to support green growth can be implemented in several areas ranging from pricing (carbon tax, environmental taxes, and so on) to market regulations

8 In the final declaration of the United Nations Conference on Sustainable Development, Rio+20, the contribution to be made by the green economy to the fulfillment of sustainable development goals was underscored. Policies about the green economy will not only support the fight against poverty (social inclusion level and welfare-enhancing) but will also contribute to the more healthy functioning of the ecosystem (UN, 2012).

(energy efficiency), incentives (supporting the use of green technology, products, and processes instead of resources harmful to the environment), and the shaping of consumer behaviors (OECD, 2015). Theories about green growth emphasize that an economic expansion that is consistent with the ecological system of the world can take place (consistent with sustainable development goals), and by virtue of the technological development, the GDP growth can be decoupled from the resource use and carbon emissions. However, Hickel and Kallis (2019) underline that empirical studies did not confirm the green growth theory, and hence, actions should be taken in light of other alternative strategies.

The challenge in producing green growth strategies and policies is that their beneficial welfare effects come into play in the long term whilst transition costs render the implementation of these policies and strategies difficult in the short term. Both the harmonization of policies and the selection of indicators and tools to measure the effectiveness of implemented policies are among the basic problems. Even if pricing tools are used in general, they should be supplemented with incentives or arrangements that address market failures. Countries generally make more efforts to invest in infrastructure and harmonization policies, however, both public and private finance should be used in these areas. Taking steps to compensate for those losing due to the implemented policies is also important. Green growth can be considered as a subset of sustainable economic development. Policies, which are consistent with flexible ecosystems in support of conditions necessary for innovation, investment, and competition that will pave the way for a new economic growth path, find their places in economic growth (OECD, 2013a).

The barriers blocking green growth differ depending on the economic development level, socioeconomic context, and existing economy and environment policies. Table 1 displayed these barriers ranging from the lack of infrastructure to externalities and incentives.

Table 1: Green Growth Constraints and Policy Options

Green growth constraints	Policy options
Inadequate infrastructure	Taxes
	Tariffs
	Transfers
	Public-private partnerships
Low human and social capital and poor institutional quality	Taxes
	Subsidy reform/removal
Incomplete property rights, subsidies	Review and reform or remove
Regulatory uncertainty	Set targets
	Create independent governance systems
Information externalities and split incentives	Labelling
	Voluntary approaches
	Subsidies
	Technology and performance standards
Environmental externalities	Taxes
	Tradable permits
	Subsidies
Low returns on R&D	R&D subsidies and tax incentives
	Focus on general-purpose Technologies
Network effects	Strengthen competition in network industries
	Subsidies/ loan guarantees for new network projects
Barriers to competition	Reform regulation
	Reduce government monopoly

Source: OECD, 2011:9.

Producing green growth strategies at the national level [9] requires coordination between institutions, participation of the private sector, and an accurate definition of long-term goals and indicators. An environmentally-friendly growth path necessitates the establishment of a balance between the predictability of long-term targets and the flexibility of strategies selected for implementation (The World Bank, 2012). Understanding how to manage short-term trade-offs between environmental policies and harmonizing them with long-term interests are also of importance. Developing countries will use their natural endowments in the economic development process. Green growth is what decision the country takes/where the country stands in relation to the use

9 In this context, the effect and responsibilities of central banks are also discussed. In general, a balance sheet in support of the transition to a low carbon economy and activities fighting climate change can be preferred (Boneva et al., 2021). Monetary policy transactions can be greenized and directing asset and liability transactions toward low carbon assets can be supported. Again, an important point is that, just as the real effect of asset purchases of the central bank on the total output, their distribution across sectors affects the climate (Papoutsi et al., 2021). The above-mentioned environmentally-friendly policies and tools indicate that the powers of the central bank should be changed in a manner to facilitate the fight against climate change and the transition to a carbon-neutral economy (Schnabel, 2021).

of these resources and where the society wants to be in this regard in the long run. Green growth does not solely mean the protection of nature, rather, it is about not regretting the decisions taken to provide natural resources that are needed to make economic development sustainable in the long run (OECD, 2013b).

Green policies and practices contribute to economic growth through three mechanisms: The increase in factors of production (such as the increase in human or natural capital), the effectiveness of the factors of production, and the innovation-supporting structure of the factors of production. It ensures that welfare gains that are not based on economic growth also emerge. Environmental policies enhance societal welfare and economic efficiency. However, it should also be borne in mind that they are costly (The World Bank, 2012).

5. Conclusion

In the context of sustainable life and economy, the concepts of green economy, circular economy and doughnut economy are frequently referred to. It is seen that the concept of sustainability is the basis of all these approaches. These concepts can be considered to be parts or components of sustainability models. This way, it will be possible to manage the process of transitioning to a new model from the dominant model/philosophy that is focused merely on growth. In today's economies, where economic growth is the main objective, the degree and form of utilization of the environment and natural resources that are among the inputs of this growth will be effective on both current and future performance.

While the Circularity Gap Report emphasized that cyclicality[10] existed in only 9.1% of the global economy in the year 2019, 62% of greenhouse gas emissions occur at the stages of acquisition, processing, and production. The meaning of this ratio is that only about 9% of the 92.8 trillion tons of minerals, fossil fuels, metals and biomass included in the economy can be applicable to reuse annually. Strategies that can be adopted to increase cyclicality may include increasing the utility of the product by maximizing its use and life cycle, supporting recycling, considering wastes as resources, and establishing a cyclical design with low-carbon alternatives by reducing the consumption of materials (The Circle Economy, 2019).

It was expected that in the Anthropocene period, which is prominent as an era in which the effects of humans and all activities of theirs, the size of man-made objects would exceed the total weight of all living beings on the

10 In the report for 2021, this rate was stated as 8.6% (The Circle Economy, 2021).

earth by the end of 2020 (Briggs, 2020). The Anthropocene, which refers to the era after the Holocene, is explained as an era in which humanity facilitates and shapes changes that occur on a global scale to a higher extent than all other factors -especially those arising with the course of nature itself. According to Crutzen (2002), the beginning of this era can be traced back to the 1800s, that is, the Industrial Revolution. While the lifestyles and economic activities of preindustrial societies used to be influential on the environment, it was seen that this effect usually remained within the range of the natural variability of the environment (in a local and transient sense) (Steffen, Crutzen, and McNeill, 2007).

According to the report of the IPCC (2021), greenhouse gas emissions caused by anthropogenic activities are the main cause of a 1.1°C increase in global temperatures since 1850-1900. It is expected that this rate of increase will reach or exceed 1.5°C in future years. Climate change does not only mean living in a warmer world and under the effects it will create. It can also result in the observation of highly variable effects on different regions (e.g., intensification of the water cycle, effects on precipitation patterns, warming and acidification of the oceans, melting of glaciers).

Developing countries are more vulnerable to environmental threats. Unsustainable destruction of natural resources, lack of basic infrastructure, inadequate access to water, energy, and food, fast population growth, urbanization-related clean air and freshwater problems, dependency of rural life on natural resources, and high vulnerability to the incidents of climate change are generally at the origin of these threats. Therefore, in developing countries, the relationship between environmental performance, inequality, and poverty emerges more visibly and directly (OECD, 2013b). There is also an unequal structure about who contributes to carbon emissions to a larger degree. The contributions to be made by rich and impoverished countries to the reduction of carbon emissions or achievement of production and consumption levels that will bring the level of global warming to the desired value will affect both groups of countries differently. It is important to consider climate policies also from this perspective.

We are living in an era in which the effects of problems caused by global warming and climate change have started to be more intensely encountered. The levels of the interactions of environmental factors with each other and their interrelations could increase the size and magnitude of negative effects that might arise even further. Economic development and existing production-consumption models have an intensifying effect on pressures on the environment and increase the frequency of ecological crises. Achieving economic growth in an environmentally sensitive manner, green growth, doughnut economy and circular economy are proposed as alternatives to the existing growth models in this context. Accordingly, it is possible to find significant differences between the Global North (rich) and Global South (poor) regarding the policies they implement and the strategies they follow. Acting with an integrative perspective that combines both the right to live humanely and the capacity of the earth to renew itself, rather than an economy focused solely on an increasing GDP, becomes inevitable on the national and global levels.

Be it circular economy or doughnut economy, all these new approaches point to the realization of a substantial transformation in conventional/direct models, that is, forms of production and consumption.

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3

The Effects of Green Innovation on Environmental Quality and Economic Growth: An Investigation for G-20 Countries

Mustafa Zuhal (Gumushane University)
ORCID: 0000-0002-4645-4628
mzuhal@gumushane.edu.tr

Abstract

Green innovation is considered the key to a sustainable environment and economic growth. Innovative activities are deemed essential in eliminating the problems of global warming. In addition, environmental technologies play an essential role in eliminating the negative effects of CO2 emissions and other harmful gases on the environment and economy. Recently, there has been intensive research on this subject in the literature. This study aimed to examine the effects of green innovation on environmental quality and economic growth in the G-20 countries during 1990-2018. The high rates of R&D activities and high CO2 emissions in G-20 countries were influential in selecting them as the sample area. Westerlund panel cointegration test was used as the analysis method in the study, and it was determined that the results of this test differ between countries. Despite this difference between countries, green innovation is generally expected to have a positive impact on economic growth. However, it has been seen that depending on the green technology applications of countries, its effects on economic growth can be positive or negative.

Keywords: Economic Growth, Environmental Quality, Green Innovation

JEL Codes: O33, O44, O57

1. Conceptual and Theoretical Framework

Green innovation plays a central role in ensuring sustainable green growth. The effects of global warming and environmental disasters make it essential to develop environment-related innovation activities. At the same time, green technologies play a crucial role in eliminating the negative effects of CO_2 emissions and other pollutants on the environment (Weina et al., 2016:254).

Economists and researchers have examined the relationship between environmental quality and economic growth for a long time. For example, Grossman & Krueger (1991) discussed environmental attrition and economic growth. Grossman & Krueger (1991) found that the amount of air pollutants increases with GDP per capita at low-income levels. However, it decreases with GDP per capita at higher income levels. Also, cleaner technologies reduce pollution per unit of output. As the income level of society rises, its members demand a healthier and more sustainable environment. For this reason, governments impose stricter environmental controls (Grossman & Krueger, 1991:5-7). Shafik & Bandyopadhyay (1992) empirically examined economic growth and environmental quality. They found that income has the most consistently significant impact on all chosen indicators of environmental quality. As the income levels of countries increase, many indicators of environmental quality tend to improve (Shafik & Bandyopadhyay, 1992: 4).

Panayotou (1993) developed the Environmental Kuznets Curve to reveal the relationship between environmental degradation and economic growth. At lower development levels, the amount of environmental degradation is limited to wastes that are less harmful to the environment. Following the acceleration of economic development, the rates of resource depletion and the harm of waste production to the environment are increasing. At higher income levels, environmental awareness, environmental regulations and higher environmental expenditures cause environmental degradation to stabilize and gradually decrease (Panayotou, 1993:1).

While R&D activities are regarded as the engine of economic growth, they provide technological advances for a cleaner environment (Grossman & Helpman, 1990:86). The majority of research on the relationship between technological change and environmental policy is interconnected for two main reasons: first, the pace and direction of technological change dramatically influence the environmental impact of social and economic activities; and second, environmental policy interventions influence the process of technological developments through constraints and incentives (Jaffe, Newell, & Stavins, 2002:61). Understanding the relationship between green technological innovations and CO_2 emissions is crucial to ensure environmental sustainability (Du, Li, & Yan, 2019:297).

Green innovation includes innovations that contribute to creating essential products, services, or processes that reduce environmental damage and degradation while optimizing natural resources production and consumption. These types of innovations ensure the balanced use of natural resources while increasing human well-being. In addition, they contribute to sustainable growth by making changes in product and production processes. Environmental innovation and eco-innovation are used synonymously with green innovation in the literature (Leal-Millán, Leal-Rodríguez, & Albort-Morant, 2017). The use of green innovation was preferred in this study.

Green innovation is defined by Kemp & Pearson (2007:7) as follows:

> *"Eco-innovation is the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organization (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives."*

The European Commission defines it as follows (European Commission, 2012:2):

> *"Eco-innovation refers to all forms of innovation – technological and non-technological – that create business opportunities and benefit the environment by preventing or reducing their impact, or by optimizing the use of resources."*

Technological innovation and technological diffusion are essential in the policies of governments to eliminate the damages of climate change. These environmental policies use two main tools; market-based instruments and non-market instruments. Empirical studies show that these policies support new environmental inventions (Nikzad & Sedigh, 2017:101). On the other hand, uncertainty in the cost and return of green technology investments makes it difficult to promote green technologies. CO_2 emissions are a global problem, but the effects of an investment in reducing emissions are uncertain for some countries. In addition, governments may attribute different values to environment-related problems. This may result in some economies not investing in CO_2 emissions. (Nikzad & Sedigh, 2017:101).

2. Literature Review

Many theoretical and empirical studies examine the relationship between green innovation, CO_2 emissions, and economic growth in the literature. This study differs from other literature studies in terms of the analysis of the country group and the series and the econometric method used.

Wang et al., 2012, examined the relationship between carbon-free energy technologies and CO_2 emissions in China. There is a long-term relationship between fossil fuel and carbon-free energy technologies. Patents on carbon-free energy technologies play a crucial role in reducing emissions.

Weina et al. (2016) investigated the role of innovation in reducing CO_2 emissions in Italy. According to the results, green patents do not significantly affect CO_2 reduction; however, it has been found to have a significant and positive effect on environmental productivity.

Esso and Keho (2016) examined the long-run relationships between economic growth, CO_2 emissions and energy consumption. The results showed that, in most African countries, economic growth and energy consumption are associated with an increase in air pollution in the long run. At the same time, it has been determined that environmental policies may have a negative impact on economic growth in many Sub-Saharan African countries.

Maryam, Mittal, and Sharma (2017) found a positive relationship between energy consumption and GDP in BRICS countries. Accordingly, the increase in GDP also increases the CO_2 emission levels.

Yii and Geetha (2017) showed that technological innovations have a negative impact on CO_2 emissions in the short run. CO_2 emissions, economic growth and technological innovation are cointegrated in the long run.

Du, Li and Yan (2019) found no evidence supporting green technological innovation reduces CO_2 emissions. However, it was observed that this relationship between green technological innovation and CO_2 emissions varies for countries with different income levels. Green innovations have a negative impact on CO_2 emissions only in high-income countries.

Fethi and Rahuma (2019) proved cointegration between GDP, R&D and CO_2 emissions. The results show a negative correlation between eco-innovation and CO_2 emissions. This means that the increase in R&D activities reduces CO_2 emissions in oil sector countries.

Mensah. et al. (2019) found that environment-related technologies are tremendously promoting green growth in the Asian subregion. In general, it was concluded that technological activities could support green growth.

Ahmad et al. (2020) detected a cointegration relationship between economic growth and technological innovations in developing countries.

Danish and Ulucak (2020) show that environmental technologies contribute positively to green growth in BRICS countries. It has been determined that non-renewable energy harms green growth, but renewable energy supports green growth.

Hussain et al. (2020) determined that environmental-related technologies and renewable energy are very important in reducing CO_2 emissions. At the same time, high GDP and imports significantly increase CO_2 emissions, while high exports greatly reduce CO_2 emissions.

Kasztelan et al. (2020) emphasized that eco-innovations have positive effects on green growth.

Mongo, Belaïd, and Ramdani (2021) emphasized that environmental innovations have a negative impact on CO_2 emissions.

Shao et al. (2021) stated that green innovation negatively affects CO_2 emissions. Also, it was found that there is a negative relationship between renewable energy and CO_2 emissions.

Yiew, Lee, and Lau (2021) found a positive long-term relationship between all three harmful emissions and economic growth in G20 countries. Moreover, CO_2 emissions have the most significant impact on real GDP.

In the current study, under the literature, green innovation is expected to negatively affect CO_2 emissions and positive effects on economic sustainability. In addition, reducing environmentally harmful wastes, thanks to green technologies increase both environmental quality and economic growth rate.

3. Data and Methodology

3.1. Data

The study used annual data of the G-20 countries for 1990-2018. These countries were selected because they have been developers of green technologies and have high CO_2 emissions. In addition, the period in which the data were obtained at a sufficient level covers 1990-2018 on a large scale. The data description and sources are shown in Table 1.

Table 1: Description and Sources of The Data

Description	Variable	Unit	Sources
Economic Growth	SGDP	GDP (constant 2010 US$)	WorldBank WDI
Green Innovation	GI	Number of Patents in Environment-related Technologies (Total)	OECD Stat
Environmental Quality	EQ	Total CO_2 emissions (thousand metric tons of CO_2)	WorldBank WDI

Patents in environmental-related technologies are a relevant indicator for green innovations (Mongo, Belaïd, and Ramdani, 2021:3; Su and Moaniba, 2017; Du, Li, and Yan, 2019). In the current study, the number of environmental-related patents indicates green innovations. Green patents were collected from the OECD Stat database (OECD Stat, 2021). In the literature, GDP has been used as an indicator of economic growth. CO_2 emissions are widely used as the environmental quality representation variable (UNDP Human Development Reports, 2021).

3.2. Methodology

Westerlund (2007) was used to obtain long-term estimates in the current studies. This test considers the assumption of cross-sectional dependence and heterogeneity between series. It also eliminates weaknesses from first-generation cointegration tests. Cointegration is tested by deciding whether each unit has its error correction. The absence of error correction in the tests means no cointegration (Tatoğlu, 2017:201). The test formula is shown as follows (Westerlund, 2007:715):

$$\Delta y_{it} = \delta_i' d_t + \alpha_i y_{it-1} + \lambda_i' x_{it-1} + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{it-j} + \sum_{j=0}^{p_i} \gamma_{ij} \Delta x_{it-j} + e_{it} \quad (1)$$

In formula 1, d_t is the vector of deterministic components (constant and trend). λ_i is the long-run parameters and γ_i is the short-run parameters. The null hypothesis of Westerlund Panel Cointegration is established as "No cointegration". In the model, OLS is estimated first to obtain group mean statistics G_a and G_t. These statistics are more reliable where the panel is heterogeneous. If the panel is homogeneous, P_a and P_t statistics are used (Tatoğlu, 2017:201-202). By comparing test statistics and probability, it is decided whether there is cointegration or not. When the null hypothesis is rejected, it is decided that there is a cointegration.

At the same time, Westerlund Panel Cointegration Tests are based on the error correction model. The panel error correction model formula is shown as:

$$\Delta Y_{it} = \phi_i (Y_{it-1} - \varnothing_i' X_{it-1}) + \sum_{j=1}^{p_i - 1} \lambda_j^* \Delta Y_{it-j} + \sum_{j=0}^{q_i - 1} \delta_j \Delta X_{it-j} + \mu_i + e_{it} \quad (2)$$

The estimation of this model gives the Westerlund mean group (MG) estimator. Parameters take values according to each unit (Tatoğlu, 2017:292).

3.3. Model Estimation

Second-generation unit root tests are used when series have cross-sectional dependence (CSD). In order to determine CSD is valid or not and to decide which type of unit root test should be used, CDS tests are performed (Tatoğlu, 2017:105). The CSD test results are shown in Table 2.

Table 2: CSD Test Results

H_0: Cross-sectional independence			
Variables	**Test**	**Statistic**	**Prob.**
EQ	Breusch-Pagan LM	2438.945	0.0000
	Pesaran scaled LM	121.6090	0.0000
	Bias-corrected scaled LM	121.2697	0.0000
	Pesaran CD	29.93738	0.0000
SGDP	Breusch-Pagan LM	4237.425	0.0000
	Pesaran scaled LM	218.8597	0.0000
	Bias-corrected scaled LM	218.5204	0.0000
	Pesaran CD	64.72835	0.0000
GI	Breusch-Pagan LM	3173.197	0.0000
	Pesaran scaled LM	161.3128	0.0000
	Bias-corrected scaled LM	160.9735	0.0000
	Pesaran CD	54.86748	0.0000

According to the CSD test results, all variables are cross-section dependent. In this case, second-generation unit root tests should be used. The Pesaran CADF test has been applied to series. The Pesaran CADF unit root test results are shown in Table 3.

Table 3: Pesaran CADF Unit Root Test Results

H_0: Series has a unit root.		
Variables	**Trend and Constant**	**Constant**
SGDP	0.978	0.882
EQ	0.939	0.141
GI	0.999	0.846
SGDP I(1)	-	0.003
EQ I(1)	-	0.000
GI I(1)	-	0.000

It is seen that all variables contain unit roots in trend and constant. The variables are stationary at the first difference of series. In this case, the variables are suitable for cointegration analysis.

Model 1: Economic Growth and Environmental Quality Relationship

The study checked the cointegration between economic growth and environmental quality in Model 1. Before the Westerlund cointegration analysis, the Pesaran and Yamagata homogeneity test was performed for the panel. The homogeneity test results of the panel are shown in Table 4.

Table 4: Homogeneity Test Result

H_0: Slope Coefficients are Homogenous		
	Delta	**p-value**
	40.286	0.000
adj.	42.547	0.000

As seen in Table 4, the Ho hypothesis is rejected. It was observed that the series were not homogeneous. At the same time, a CSD tests were performed for Model 1. CSD results are shown in Table 5.

Table 5: CSD Test Results

H_0: Cross-sectional Independence		
Test	**Statistic**	**p-value**
LM	885.3	0.0000
LM adj*	114	0.0000
LM CD*	11.77	0.0000

**two-sided test*

There is both CSD and heterogeneity in Model 1. For this reason, it is appropriate to use the Westerlund cointegration. The Westerlund Cointegration results are shown in Table 6.

Table 6: Westerlund Cointegration Test Results

H_0: No Cointegration				
Statistic	**Value**	**Z-value**	**P-value**	**Robust P-value**
Gt	-2.777	-2.284	0.011	0.750
Ga	-27.666	-10.333	0.000	0.030
Pt	-10.107	-1.046	0.148	0.770
Pa	-16.632	-5.603	0.000	0.680

In Westerlund cointegration tests, in case the panel is heterogeneous, the statistical values of G_t and G_a are evaluated. Since the probability value of G_a is less than 0.05, the H_0 hypothesis is rejected. There is a long-run cointegration between economic growth and environmental quality.

After the cointegration test, the long-run coefficients were obtained via MGE. Mean Group Estimator (MGE) test results are shown in Table 7.

Table 7: MGE Results

SGDP	Coef.	Std. Err.	z	P>|z|
EQ	-0.0810184	0.0370608	-2.19	0.029
cons	0.7778574	4.402777	0.18	0.860

As a result of the MGE, there is a negative relationship between CO_2 emissions and economic growth. Reducing CO_2 emissions contributes to environmental quality. In other words, ensuring environmental quality accelerates economic growth. In Model 1, there is a long-run, negative and significant relationship between the variables. An increase of 1 % in CO_2 emissions reduces economic growth by 0.08% in G-20 countries. G-20 countries should attach importance to policies that reduce CO2 emissions in this respect. In addition, country-specific coefficients are shown in Table 8.

Table 8: Country-Specific Coefficients

	Coef.	**Std. Err.**	**z**	**P>|z|**
Argentina				
EQ	-0.1677525	0.031469	-5.33	0.000***
cons	-0.126548	2.950663	-0.04	0.966
Australia				
EQ	-0.0496952	0.0302571	-1.64	0.101
cons	5.068783	1.694861	2.99	0.003***
Brazil				
EQ	-0.2030025	0.1527671	-1.33	0.184
cons	-11.78001	14.46152	-0.81	0.415
Canada				
EQ	-0.1243889	0.0230291	-5.40	0.000***
cons	5.887021	4.032349	1.46	0.144

	Coef.	Std. Err.	z	P>|z|
China				
EQ	0.0103211	0.0987626	0.10	0.917
cons	-205.111	73.05693	-2.81	0.005***
France				
EQ	0.1935278	0.3183165	0.61	0.543
cons	28.85933	8.871278	3.25	0.001***
Germany				
EQ	-0.5354537	0.1000371	-5.35	0.000***
cons	6.36445	5.778221	1.10	0.271
India				
EQ	0.0523389	0.0524342	1.00	0.318
cons	-34.6925	14.35412	-2.42	0.016**
Indonesia				
EQ	-0.0835355	0.0114602	-7.29	0.000***
cons	-12.52427	4.012.138	-3.12	0.002***
Italy				
EQ	0.7976059	0.1168582	6.83	0.000***
cons	14.40488	7.792005	1.85	0.065*
Japan				
EQ	-0.3344547	0.3001933	-1.11	0.265
cons	18.51686	16.07182	1.15	0.249
Mexico				
EQ	-0.0592498	0.031061	-1.91	0.056*
cons	7.485638	3.679958	3.22	0.042**
Russia				
EQ	-0.1273429	0.0113991	-11.17	0.000***
cons	-22.73723	10.18895	-2.23	0.026**
Saudi Arabia				
EQ	0.0281115	0.0162978	1.72	0.085*
cons	-11.63554	3.604432	-3.23	0.001***
South Africa				
EQ	0.0030408	0.0049471	0.61	0.539
cons	0.6349448	1.692159	0.38	0.707
South Korea				
EQ	0.0090789	0.015153	0.60	0.549
cons	0.6007357	2.414398	0.25	0.804
Turkey				
EQ	-0.0931642	0.0352989	-2.64	0.008***
cons	-13.46358	4.839672	-2.78	0.005***
United Kingdom				
EQ	-0.2559069	0.2100951	-1.22	0.223
cons	30.15866	10.31558	2.92	0.003***
USA				
EQ	1.655368	1.303.897	1.27	0.204
cons	146.2707	54.25442	2.70	0.007***

*Note: *** 1%, ** 5% and * 10% are significant.*

Mixed results were obtained between CO_2 emissions and economic growth in country-specific coefficients. Insignificant results were found in Brazil, China, France, India, Japan, South Africa, South Korea, the United

Kingdom, and the USA. Negative and significant results were found in Argentina, Canada, Germany, Indonesia, Mexico, Russia, and Turkey. Projects to reduce CO_2 emissions in these countries yield positive results for economic growth. Positive and significant results were found in Italy and Saudi Arabia. Economic growth in these countries increases CO_2 emissions. In these countries, importance should be given to environmental technologies and projects in ensuring environmental sustainability.

Model 2: Environmental Quality and Green Innovation Relationship

In Model 2, the relationship between environmental quality and green innovation is examined. First of all, the homogeneity test was made before the cointegration test in Model 2. Homogeneity test results are shown in Table 9.

Table 9: Homogeneity Test Result

H_0: slope coefficients are homogenous		
	Delta	**p-value**
	33.888	0.000
adj.	35.790	0.000

The null hypothesis was rejected as a result of the homogeneity test. Variables are heterogeneous. Also, CSD was tested for model 2.

Table 10: CSD Test Results

H_0: Cross-sectional independence		
Test	**Statistic**	**p-value**
LM	811	0.0000
LM adj*	101.4	0.0000
LM CD*	9.67	0.0000

The null hypothesis was rejected as a result of the CSD tests. Cross-section dependence was found in these series. As a result of the tests, Using the Westerlund cointegration test was appropriate in Model 2. Westerlund cointegration results are shown in Table 11.

Table 11: Westerlund Cointegration Results

H_0: No cointegration				
Statistic	**Value**	**Z-value**	**P-value**	**Robust P-value**
Gt	-2.612	-1.391	0.082	0.410
Ga	-17.949	-3.965	0.000	0.010
Pt	-10.120	-1.061	0.144	0.560
Pa	-9.023	-0.050	0.480	0.700

As a result of the Westerlund cointegration test, there is cointegration between green innovation and environmental quality in G-20 countries. Environmental quality and environmental technological innovations act together in the long run. At the same time, the MGE coefficients were obtained. MGE coefficients are shown in Table 12.

Table 12: MGE Results

EQ	Coef.	Std. Err.	z	P>|z|
GI	0.1379935	0.2612871	0.53	0.597
cons	-112.653	4.081.389	-0.28	0.783

As seen in Table 12, an insignificant result was found for EQ and GI in Model 2. Country-specific coefficients are shown in Table 13.

Table 13: Country-specific coefficients

	Coef.	Std. Err.	z	P>|z|
Argentina				
GI	0.7621367	3.986893	0.19	0.848
cons	2.089423	8.380576	2.49	0.013**
Australia				
GI	0.7542294	0.1279618	32.629	0.000***
cons	2.570306	3.701506	0.69	0.487
Brazil				
GI	-1.249785	1.214027	-1.03	0.303
cons	-4.386473	9.649729	-0.45	0.649
Canada				
GI	-0.0483825	0.3078493	-0.16	0.875
cons	-0.056855	1.021136	-0.01	0.996
China				
GI	0.035208	0.1111411	0.32	0.751
cons	2.700442	6.533819	4.13	0.000***
France				
GI	-0.0641148	0.0417139	-1.54	0.124
cons	0.7561968	2.622748	0.29	0.773
Germany				
GI	-0.096876	0.0236975	-4.09	0.000***
cons	18.81735	4.759064	3.95	0.000***
India				
GI	1.646371	1.150543	1.43	0.152
cons	-4.616623	2.334873	-0.20	0.843
Indonesia				
GI	26.47442	22.11507	1.20	0.231
cons	-95.74373	3.578026	-2.68	0.007***
Italy				
GI	0.5792387	0.2122187	2.73	0.006***
cons	-6.85237	5.904892	-1.16	0.246
Japan				
GI	0.0335168	0.0272926	1.23	0.219
cons	1.225637	6.687361	0.18	0.855

	Coef.	Std. Err.	z	P>|z|
Mexico				
GI	2.213984	2.394516	0.92	0.355
cons	-23.63021	12.53525	-1.89	0.059*
Russia				
GI	-3.562061	7.119205	-0.50	0.617
cons	-162.4409	85.87509	-1.89	0.059*
Saudi Arabia				
GI	-0.6154476	1.09963	-0.56	0.576
cons	-12.54842	21.25367	-0.59	0.555
South Africa				
GI	6.581115	2.662261	2.47	0.013**
cons	-28.66788	32.22498	-0.89	0.374
South Korea				
GI	0.3086276	0.0665776	4.64	0.000***
cons	-23.18668	13.33006	-1.74	0.082*
Turkey				
GI	-2.929093	0.8550114	-3.43	0.001***
cons	17.52786	14.39518	1.22	0.223
United Kingdom				
GI	-0.0530082	0.093212	-0.57	0.570
cons	13.82064	4.157185	3.32	0.001***
USA				
GI	-0.0098256	.0096376	-1.02	0.308
cons	7.272556	3.59199	2.22	0.043**

*Note: *** 1%, ** 5% and * 10% are significant.*

As a result of the country-specific MGE test, different findings were obtained. Insignificant results were obtained in Argentina, Brazil, Canada, China, France, India, Indonesia, Japan, Mexico, Russia, Saudia Arabia, the United Kingdom, and the USA. Positive and significant results were obtained in Australia, Italy, and South Korea. These results were contrary to expectations. While patents in environmental-related technologies are increasing in these countries, CO_2 emissions are also increasing. This means that the positive effects of green technology projects on the environment are not seen in these countries.

There is a negative relationship between environmental quality and green innovation in Germany and Turkey. The increase in patents related to the environment reduces CO_2 emissions. In these countries, technology applications related to the environment have positive results in reducing emissions.

Model 3: Economic Growth and Green Innovation Relationship

The current study tested the cointegration between economic growth and green innovation as the third model. First, the homogeneity test of the model was performed. Homogeneity test results are shown in Table 14.

Table 14: Homogeneity Test Result

H_0: slope coefficients are homogenous		
	Delta	**p-value**
	49.367	0.000
adj.	52.137	0.000

As a result of the homogeneity test, H_0 hypothesis was rejected. The model is heterogeneous. Also, cross-section dependency was checked. CSD test results are shown in Table 15.

Table 15: CSD Test Results

H_0: Cross-sectional independence		
Test	**Statistic**	**p-value**
LM	880.9	0.0000
LM adj*	112.5	0.0000
LM CD*	14.95	0.0000

As a result of the CSD test, the H_0 hypothesis was rejected, and there is a CSD in the model. The model has both heterogeneity and CSD. In this case, the Westerlund cointegration test is appropriate. Westerlund cointegration result is shown in Table 16.

Table 16: Westerlund Cointegration Results

H_0: No cointegration				
Statistic	**Value**	**Z-value**	**P-value**	**Robust P-value**
Gt	-2.635	-1.515	0.065	0.790
Ga	-39.342	-17.984	0.000	0.000
Pt	-8.342	1.011	0.844	0.820
Pa	-18.316	-6.832	0.000	0.190

As a result of the cointegration test, cointegration was found in Model 3. Economic growth and green innovation are cointegrated in the long run. At the same time, country-specific coefficients are obtained. MGE results are shown in Table 17.

Table 17: MGE Results

SGDP	Coef.	Std. Err.	z	P>|z|
GI	0.1738288	0.0559667	3.11	0.002
cons	1.692678	2.504015	0.68	0.499

A positive relationship was found between green innovation and economic growth in the MGE test results. An increase of 1% in green innovation increases economic growth by 0.17 % in G-20 countries. In addition, country-specific coefficients are shown in Table 18.

Table 18: Country-specific coefficients

	Coef.	Std. Err.	z	P>|z|
Argentina				
GI	0.1772856	0.7871626	0.23	0.822
cons	-0.0478334	0.5150838	-0.09	0.926
Australia				
GI	0.0280597	0.032171	0.87	0.383
cons	0.1923319	0.3157859	0.61	0.542
Brazil				
GI	-0.102038	0.5500511	-0.19	0.853
cons	636.482	1.393.315	4.57	0.000***
Canada				
GI	0.2299559	0.0785376	2.93	0.003***
cons	-1.059171	.8626834	-1.23	0.220
China				
GI	0.4071216	0.0432352	9.42	0.000***
cons	-236.265	8.324.036	-2.84	0.005
France				
GI	0.0626433	0.0719343	0.87	0.384
cons	1.085022	1.410707	7.69	0.000***
Germany				
GI	0.0366185	0.0214429	1.71	0.088
cons	8.377498	1.409179	5.94	0.000***
India				
GI	1.578603	0.2979633	5.30	0.000***
cons	-1.138262	2.011283	-5.66	0.000***
Indonesia				
GI	-3.390075	2.123935	-1.60	0.110
cons	-5.519798	1.068375	-5.17	0.000***
Italy				
GI	0.4268752	0.1993342	2.14	0.032**
cons	1.387818	1.723823	8.05	0.000***
Japan				
GI	0.0705091	0.0372272	1.89	0.058*
cons	2.080052	2.742497	7.58	0.000***
Mexico				
GI	0.2870275	0.2824841	1.02	0.310
cons	0.9058461	0.4611069	1.96	0.049**
Russia				
GI	-0.5457832	0.754558	-0.72	0.469
cons	-8.486303	3.014519	-2.82	0.005***
Saudi Arabia				
GI	0.3319056	0.1047698	3.17	0.002***
cons	-1.173694	0.657399	-1.79	0.074*
South Africa				
GI	0.1313752	0.055468	2.37	0.018**
cons	-0.9852227	0.2148233	-4.59	0.000***
South Korea				
GI	-0.0117291	0.00759	-1.55	0.122
cons	-0.4478102	0.5064402	-0.88	0.377

	Coef.	Std. Err.	z	P>|z|
Turkey				
GI	0.9643495	0.1675719	5.75	0.000***
cons	-3.109464	0.9317762	-3.34	0.001***
United Kingdom				
GI	0.3074583	0.0994388	3.09	0.002***
cons	6.080817	1.469978	4.14	0.000***
USA				
GI	0.2815809	0.0614134	4.59	0.000***
cons	2.776715	7.637568	3.64	0.000***

*Note: *** 1%, ** 5% and * 10% are significant.*

Mixed results were obtained with country-specific coefficients. The results differ because the countries are not homogeneous. The coefficients are insignificant in Argentina, Australia, Brazil, France, Indonesia, Mexico, Russia, and South Korea. However, significant coefficients were found in Canada, China, Germany, India, Italy, Japan, Saudi Arabia, South Africa, Turkey, the United Kingdom, and the USA. An increase of 1% green innovation increases economic growth in Canada (0.22%), China (0.40%), Germany (0.03%), India (1.57%), Italy (0.42%), Japan (0.07%), Saudia Arabia (0.33%), South Africa (0.13%), Turkey (0.96%), United Kingdom (0.30%), and USA (0.28).

4. Conclusion

Innovation is seen as the essential element of sustainable economic growth. At the same time, the negative results of global warming affected the welfare level of countries. For this reason, environment-related technologies have gained importance. Countries have made significant investments in green technologies for a long time in the fields of transportation and power generation, transmission, and distribution with the aim of struggling with climate change (Mongo, Belaïd, and Ramdani, 2021:1). Also, many studies have been carried out about the economic effects of environment-related technologies in the academic area.

The current study aimed to examine the effects of green innovation on environmental quality and economic growth in the G-20 countries during 1990-2018. The high rates of R&D activities and high carbon dioxide emissions in G-20 countries were effective in the selection of them as the sample. Westerlund (2007) cointegration analysis was performed because of cross-sectional dependence and heterogeneity in the series. At the same time, the country-specific long-run coefficient was estimated by using MGE.

As a result of the analysis, different results were obtained for countries. The first model was established to examine the relationship between economic growth and environmental quality. A negative correlation was found between economic growth and CO_2 emissions in the panel. Country-specific coefficients also supported these results. However, some countries are positively correlated. These results are compatible with the literature. According to this, the positive link between economic growth and harmful gases indicates that increased energy use can trigger economic growth. However, the dependence on non-renewable energy sources, on the one hand, leads to higher economic growth, on the other hand causing excessive pollutants in the atmosphere in the G20 countries. Policymakers should prefer alternative cleaner energy types to fossil fuels. The choice of renewable and cleaner energy types is vital for long-term sustainable development (Yiew, Lee, and Lau, 2021:11466).

The second model analyzed the relationship between environmental quality and green innovation. Green innovation and CO_2 emissions are cointegrated in the long run. No significant coefficients were found for the whole panel. However, country-specific results were found to be different from each other rather than homogeneous. Green technological activities were found to have limited effects on CO_2 emissions. Also, empirical results differ between developed and developing countries. For example, while developed countries with high environmental awareness focus on economic growth to improve welfare standards, sufficient incentives are not given to green technological innovations due to the financial situation in developing countries. Therefore, the effects of green innovations on CO_2 emissions are quite limited in developing countries. On the contrary, in developed countries, the desire for a better life is stronger, and governments are more willing to promote green innovations (Du, Li, and Yan, 2019:300).

The relationship between economic growth and green innovation was examined in the third model. There is cointegration between green innovation and economic growth. Also, a positive result was found for the whole panel. It has been determined that green innovation activities support economic growth.

As a result, green innovation activities, directly and indirectly, affect the economy. These activities reduce CO_2 emissions and support economic growth. However, the effects of green innovation are still limited. In this respect, countries should give more importance to green innovation activities for a sustainable environment and economic growth.

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4

Examining the Impact of Climate Change on Sustainable Development: Case of Turkey

Nuri Baltacı (Gumushane University)
ORCID: 0000-0002-7001-2889
nbaltaci@gumushane.edu.tr

Hikmet Akyol (Güöüşhane University)
ORCID ID: 0000-0001-9119-7416
hikmetakyol76@gmail.com

Abstract

This research examined the extent to which climate change affects the country's level of sustainable development. The results showed that the increased temperature and precipitation had a positive and meaningful effect on the development level of the country. The effect of humidity rates on sustainable development rates was found to be negative and significant. Variance decomposition analyses have shown that climate indicators significantly explain the periodic variation change in development. The findings showed that temperature ratios and precipitation have an extremely strong interaction with sustainable development. The study also analyzed the effects of climate change on Turkey's agricultural sustainability within the framework of sustainable development. The increased temperature and precipitation negatively affected the added value of agriculture, forestry, and fisheries, while humidity rates had a positive and meaningful effect. The COVID-19 pandemic has shown that the agricultural sector and food security have an important place in the future of nations. Especially in the long term, rising temperatures can lead to the spread of drought in the country, causing serious agricultural problems, increasing the sensitivity of other sectors to the climate, and increasing economic costs. In addition, the country's water quality may deteriorate. Therefore, uncompromising implementation of adaptation, preparation, and mitigation policies that will ensure climate control in the country is very important.

Keywords: Sustainable Development, Climate Change, Sustainable Agriculture, Macroeconomics

JEL Codes: O11, O13, G20

1. Introduction

Although theoretically, there is a correct relationship between the desire to meet sustainable development goals and the drive to protect environmental resources and the biosphere, environmental sensitivities in practice can remain in the background. In many countries, governments can be weak in tackling climate change, considering economic and political sensitivities, such as re-election anxiety, reducing unemployment, and achieving rapid growth. In addition, rising global demand and energy prices during the COVID-19 pandemic, the cost of developing methods to reduce carbon emissions in many industrial sectors, and economic concerns in developing countries make it difficult to meet the global climate commitments made at the 2015 Paris Climate Agreement and the 2021 United Nations Climate Change Conference (COP26) soon. However, trying to control climate change using appropriate policies is important for reducing economic losses because of the negative effects of climate change in the long term (Jones et al., 2009). Research has shown that climate change will negatively impact economic performance in many developing countries by the end of the century (Dell et al., 2008; Dell et al., 2012; Alagidede et al., 2015; Lee et al., 2016). Therefore, preparations for adaptation to climate change should be adopted and implemented as a basic government policy. Studies have shown that improved adaptation policies can reduce the negative effects of the climate on the economy (Adom and Amoani, 2021). There are serious steps taken in this direction in developed countries. For example, the European Green Deal, which aims to reset greenhouse gas emissions in EU member states by 2050, is one of these initiatives. The Green Deal is also a growth strategy aimed at creating new business opportunities and increasing prosperity by separating economic growth from sourcing (EscarusBlog, 2020).

The economic development of Turkey has gained momentum with the increase in real and trade relations with the world after the 80s, similar to other developing countries. During this period, import-substitution policies were abandoned, priority was given to exports, and tourism was encouraged. Table 1 shows Turkey's GDP growth rates per capita and human development index (HDI) data for the period 1995-2020. It is valued between HDI 0-1 calculated by the United Nations Development Programme (UNDP). That the index value is closer to 1 indicates that the development level of the countries has increased, while the approach to 0 means that development is low. Although Turkey's GDP has contracted in some years because of crises and shocks, its HDI has increased during the period.

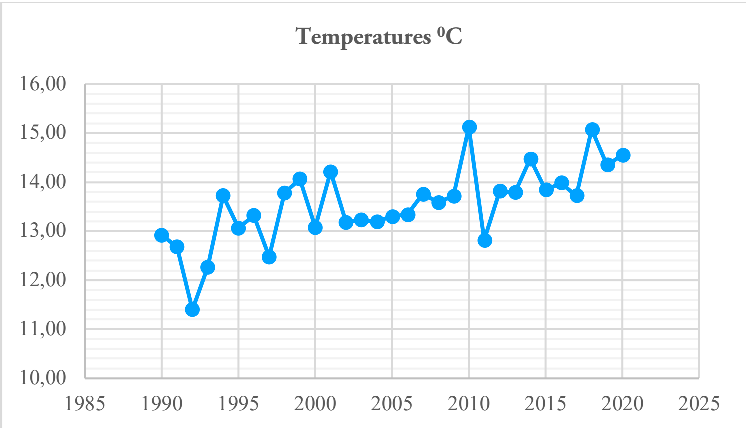
Table 1: Turkey's Development Indicators in the Period 1990-2020

Year	GDP	HDI
1995	6.18	0.611
1996	5.69	0.62
1997	5.89	0.629
1998	0.81	0.64
1999	-4.75	0.648
2000	5.32	0.66
2001	-7.15	0.666
2002	4.89	0.677
2003	4.25	0.684
2004	8.29	0.69
2005	7.56	0.696
2006	5.62	0.704
2007	3.80	0.712
2008	-0.38	0.714
2009	-6.03	0.720
2010	6.92	0.739
2011	9.51	0.753
2012	3.09	0.765
2013	6.66	0.785
2014	3.17	0.796
2015	4.33	0.801
2016	1.64	0.808
2017	5.79	0.814
2018	1.45	0.817
2019	-0.43	0.820
2020	0.70	-

Source: Data from UNDP and World Bank official databases regulated by researchers

With the increased development during the period, the costs of climate change in the economy have increased. Agriculture is one of the sectors affected by climate change in the country. Especially in Turkey, where the agricultural sectors are widely covered, extreme heat and changes in precipitation distribution have increased the frequency of flood and drought disasters seen in recent years. This situation led to the loss of production in the agricultural sector and an increase in food prices and negatively affected the forestry and fishing sectors. Demircan et al. (2017) predicted that average temperatures in Turkey will increase between $^{0}1$-$^{0}6$ in 2016-2099, while the amount of precipitation will generally decrease outside winter. In Figure 1, Turkey's average annual temperature changes in the period 1990-2020 are given. Average annual temperature changes during the period peaked in 2010. In addition, temperatures have been on an upward trend, especially in recent years.

Figure 1: Annual Average Temperature Changes in Turkey (1990-2020, 0C)



Source: Data from Turkish State Meteorological Service regulated by researchers

In Turkey, the policies of combating climate change and adaptation came to the fore after the 2000s. During this period, Turkey's Climate Change Strategy/IDES, the Climate Change Action Plan/IDEP (2011-2023) covering 2010-2020, and Turkey's Climate Change Adaptation Strategy and Action Plan (2011-2023), which includes the effects of direct climate change in the country, were prepared (Republic of Turkey Ministry of Environment and Urbanization, 2020:14). Furthermore, the Paris Climate Agreement, signed in 2015, which aims to limit global temperature rise to less than 2 degrees Celsius above pre-industrial levels, was approved by the Parliament in 2021.

In this research, the impact of climate change on sustainable development in Turkey was examined. In this context, the extent to which the changes in average annual temperature, precipitation, and humidity affect the human development level of the country was analyzed. Simultaneously, Turkey's sensitivity to climate change and sustainable agricultural production have been investigated.

2. Literature

The concrete observation of the effects of climate change on development has increased academic interest in the relationship between these variables. However, empirical studies examining the relationship between climate change and sustainable development have been observed to be relatively limited.

Dell et al. (2012) analyzed the relationship between temperature shocks and economic growth in 125 countries between 1950-1959 and 1996-2005. The study using panel data methods has shown that high temperatures significantly reduce economic growth. The results revealed that high temperatures reduce not only output levels, but also growth rates. Researchers have shown that high temperatures also negatively affect agricultural and industrial production and political stability.

Akram (2012) analyzed the relationship between climate change and economic growth in Asian countries in the period 1972-2009. The research using panel data estimators showed that economic growth was negatively affected by changes in temperature, precipitation, and population growth. Urbanization and human development have been observed to stimulate economic growth.

Alagidede et al. (2015) estimated the short- and long-term relationship between climate change and economic growth in 18 sub-Saharan countries between 1970 and 2009. In the study where panel data analysis methods were applied, it was determined that temperatures above 24 ^{0}C would significantly reduce economic performance. The researchers showed that the relationship between real GDP and temperature increases was not linear. In the absence of policies to mitigate the negative effects of climate change, the study estimated that a permanent increase in average global temperature of 0.04 °C per year would reduce world GDP per capita by more than 7% by 2100.

Lee et al. (2016) analyzed the impact of temperature shocks in Asia on economic growth and prosperity. Researchers have shown that rising temperatures affect economic efficiency through investment channels of industrial production, as well as agricultural production. According to the results, economic productivity in developing Asian countries is projected to fall by 10% by 2100.

Dumrul and Kilicarslan (2017) analyzed the impact of climate change on the agricultural sector in Turkey during the period 1961-2013. In the study where the ARDL bounding test method was applied, it was shown that the increase in precipitation positively affected agricultural GDP. However, temperature increases had a negative effect on agricultural GDP.

Bai et al. (2019) analyzed climate change and low-carbon agricultural production for 142 local regions in China's Hebei province between 2000 and 2010. The results of the analysis showed that carbon emissions in agriculture increased by 15.85% (650 million tons) and carbon emissions in agricultural ecosystems increased by 33.82% (13.8 million tons) during the period 2000-2010.

Destek and Sarkodie (2019) examined the relationship between economic development and ecological footprint in 11 newly industrialized countries in the period 1977-2013. The study, which used panel data analysis forecasters, demonstrated an inverse-U relationship between economic growth and ecological footprint. Causality test results revealed two-way causality between variables.

Kahn et al. (2019) estimated the long-term macroeconomic effects of climate change in 174 countries during the period 1960-2014. The researchers found that persistent temperature changes above and below the historical norm negatively affected the level of production. However, no significant effect of precipitation was observed at the production level.

Liu (2019) examined the relationship between economic development, water quality, and climate change in China. Researchers have shown that economic development plays an important role in the development of the aquatic environment and that climate change is also involved. The study found that economic growth and climate change negatively affected water quality.

Adom and Amoani (2021) estimated the role of climate adaptation preparation in economic growth and climate change in 44 African countries between 2006 and 2016. In the study using panel data analysis, temperature increases were shown to have a negative effect on economic growth and productivity. However, these effects were found to depend on the level of compliance readiness.

Akyol (2021) examined the relationship between climate change and economic development in newly industrialized countries in the period 1992-2019. The study, which used panel data analysis estimators, has shown that annual average temperature increases and carbon dioxide gas emissions positively affect economic development.

Dolge and Blumberga (2021) analyzed the main drivers of GHG emissions in the UK and EU member states in the period 2010-2019 and examined the progress made in implementing the Green Deal targets. The study, which used decomposition analyses, has shown that improvements in energy efficiency in the EU have twice as much impact on reducing GHG emissions as RES strategies. The researchers found that economic growth was an important factor preventing the reduction of GHG emissions.

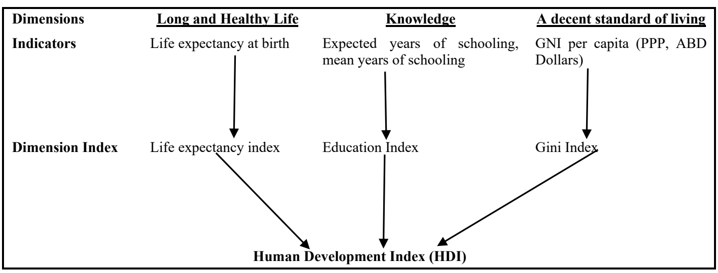
3. Method and Data

In this section, the data set of the research and the econometric method used are given.

3.1. Data

In this research, the impact of climate change on sustainable development is examined. For this purpose, the effect of average temperature changes, precipitation amounts, and humidity rates on the level of human development in Turkey during the period 1990-2020 was analyzed. In the study, average temperature change (^{0}C), precipitation (mm), and humidity rates were obtained from the Turkish State Meteorological Service. The human development index, which was developed by the United Nations Development Programme, has been used as a proxy indicator for sustainable development. This index emphasizes that people and their abilities are a measure of the economic growth of countries as well as their level of development (UNDP, http://hdr.undp.org/en/content/human-development-index-hdi). Figure 2 shows the components of the HDI developed by UNDP.

Figure 2: HDI



Source: http://hdr.undp.org/en/content/human-development-index-hdi, 15.11.2021

Secondly, Turkey's agricultural sustainability was examined in the context of sustainable development. The added value of agriculture, forestry, and fisheries was used to represent the agricultural sector. In addition, gross fixed capital formation (%of GDP) was used to represent capital formation. Agriculture and capital formation variables are taken from the official database of the World Bank. The research variables are given in Table 2.

Table 2: Research Variables

Variable	Explanation	Type	Source
HDI	UNDP human development index	The level value of the index is used.	UNDP, http://hdr.undp.org/en/indicators/137506
AGR_GDP	Added value of agriculture, forestry, and fishing	The ratio to GDP is used.	World Bank
LN (TEMP)	Annual average temperature change (C^0)	Natural logarithms have been taken.	Turkish State Meteorological Service
LN(PREP)	Annual average precipitation amount (mm)	Natural logarithms have been taken.	Turkish State Meteorological Service
LN (HUM)	The average amount of humidity per year	Natural logarithms have been taken.	Turkish State Meteorological Service
INVEST_GDP	Gross fixed capital formation	The ratio to GDP is used.	World Bank

3.2. Method

In the study, the econometric relationship of climate change with sustainable development was analyzed using the Least Squares (OLS) estimator. Here are the model functions that show the relationship between variables:

$$HDI_t = f(LN(TEMP)_t, LN(PREP)_t, LN(MOIS)_t, INVEST\_GDP_t) \qquad (1)$$

$$AGR\_GDP_t = f(LN(TEMP)_t, LN(PREP)_t, LN(MOIS)_t, INVEST\_GDP_t) \qquad (2)$$

Here, HDI and AGR_GDP variables represented the added value of agriculture, forestry, and fisheries with the human development index. The LN (TEMP), LN(PREP), LN(MOIS), and INVEST_GDP descriptive variables, respectively; represented the average annual temperature change, the amount of precipitation, humidity, and capital formation. The OLS formats of the predicted linear models are as follows:

$$HDI_t = \alpha_0 + \beta_1 LN(TEMP)_t + \beta_2 LN(PREP)_t + \beta_3 LN(MOIS)_t + \beta_4 INVEST\_GDP_t + \mu_t \qquad (3)$$

$$AGR\_GDP_t = \alpha_0 + \beta_1 LN(TEMP)_t + \beta_2 LN(PREP)_t + \beta_3 LN(MOIS)_t + \beta_4 INVEST\_GDP_t + \mu_t \qquad (4)$$

Here it represents the constant parameter "α", the slope coefficient parameters "β", the time size "t", the error term "μ". VAR impact-response and variance parsing analyses were used to determine the dynamic relationship between variables and the ratio of descriptive variables to the dependent variable.

4. Empirical Findings

The descriptive statistics for the variables are given in Table 3. Deviations may occur in econometric predictions made with series that do not show a normal distribution, and the forecast results may lose credibility. Probe values of jarque-bera test statistics showing the normal distribution rates of variables were found above p<=0.05. Therefore, all series have shown a normal distribution. In addition, the observation size (T) must be sufficient in time series analysis (T<=30). As shown in Table 3, the observation size of the estimated sample is 30[1]. The average value of the HDI is 0.697. As previously stated, the HDI value varies in the range of 0-1. The fact that the index value is close to 1 indicates that the level of sustainable development is high, while the approach of 0 indicates that development is low. The maximum value of HDI is 0.820 and the minimum value is 0.583. The average, maximum, and minimum values of AGR_GDP were 10,204, 17,476, and 5,776. The mean values of the descriptive variables LN (TEMP), LN(PREP), INVEST_GDP and LN (HUM) were 2,601, 6,435, 25,198 and 4,149, and their maximum values were 2,716, 6,676, 29,857 and 4,200. The minimum values of these variables are, respectively; 2,433, 6,200, 17,950, and 4,087, were calculated.

Table 3: Descriptive Statistics

	HDI	AGR_GDP	LN(TEMP)	LN(PREP)	INVEST_GDP	LN(HUM)
Mean	0.697	10.204	2.601	6.435	25.198	4.149
Median	0.693	9.066	2.613	6.457	25.351	4.150
Maximum	0.820	17.476	2.716	6.676	29.857	4.200
Minimum	0.583	5.776	2.433	6.200	17.950	4.087
Std. Dev.	0.077	3.707	0.058	0.104	3.227	0.026
Jarque-Bera	2.025	3.434	2.605	0.440	1.383	0.157
Prob.	0.363	0.179	0.271	0.802	0.500	0.924
Observations	30	30	30	30	30	30

In the estimated econometric analyses, whether there were multiple linear correlation problems was examined through the correlation matrix. Although the correlation relationship between HDI and AGR_GDP dependent variables was very high, the correlation coefficients of other descriptive variables were found to be acceptable.

1 The observation value of non-HDI series is 31. However, since HDI is not the index value of 2020, the average observation value of the sample is calculated as 30.

Table 4: Correlation Matrix

	HDI	AGR_GDP	LN(TEMP)	LN(PREP)	INVEST_GDP	LN (HUM)
HDI	**1.000**					
AGR_GDP	-0.918	**1.000**				
LN(TEMP)	0.650	-0.627	**1.000**			
LN(PREP)	0.073	-0.051	0.260	**1.000**		
INVEST_GDP	0.626	-0.436	0.210	-0.179	**1.000**	
LN(HUM)	-0.666	0.746	-0.370	0.399	-0.391	**1.000**

When the time graphs of the series are examined in Figure 3, it is determined that there are trend trends in the direction of increase and decrease, although there is no seasonality effect. Therefore, trend trends were considered when studying the stationarity of series.

Figure 3: Time chart of series

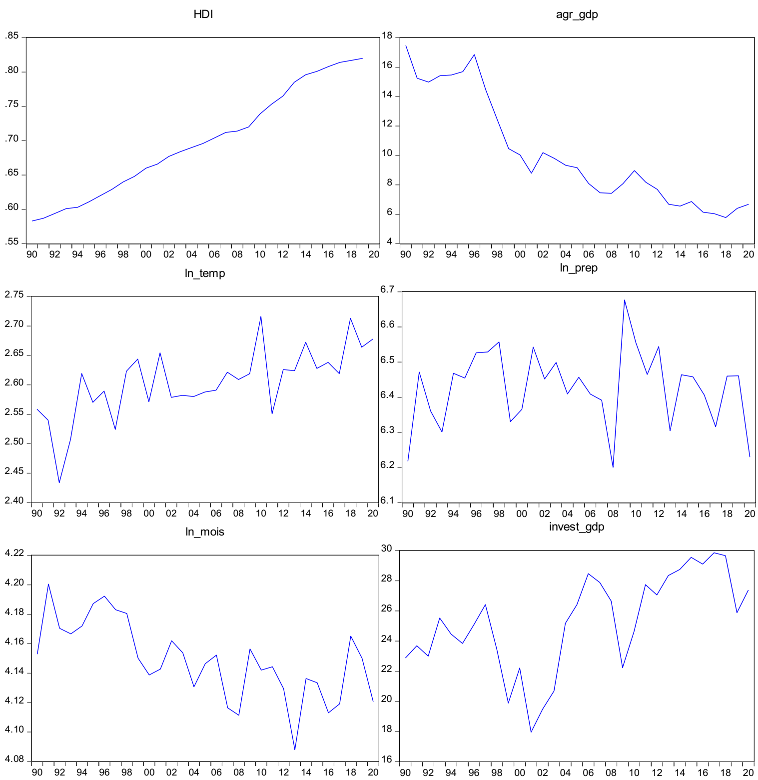


Table 5: ADF and PP Unit Root Test

	ADF		PP	
LEVEL				
	Intercept	Trend Intercept	Intercept	Trend Intercept
HDI	-0.353	-3.798**	0.177	-2.283
AGR_GDP	-1.943	-1.684	-1.959	-1.989
LN(TEMP)	-3.434***	-5.928***	-3.329**	-6.026***
LN(PREP)	-5.816***	-5.655***	-5.945***	-5.927***
INVEST_GDP	-1.965	-2.497	-1.983	-2.497
LN(HUM)	-2.649*	-4.406***	-2.638*	-4.376***
DIFFERENCE				
Δ HDI	-3.347**	-3.198	-3.372**	-3.222
Δ AGR_GDP	-4.679***	-4.644***	-4.683***	-4.626***
Δ LN(TEMP)	-6.883***	-6.732***	-22.168***	-21.391***
Δ LN(PREP)	-6.476***	-6.485***	-16.905***	-27.279***
Δ INVEST_GDP	-5.657***	-5.544***	-5.676***	-5.558***
Δ LN(HUM)	-6.841***	-6.695***	-15.855***	-19.681***

****, ** and * represented significance at the level of p<=0.01, p<=0.05 and p<=0.10.*

In the framework of the research, the stationarity of the variables was investigated using ADF and PP unit root tests. Table 5 shows the results of the unit root test. All series except AGR_GDP at the level showed stationarity. However, when the first difference of the series is taken, all variables are stationary. During the research period, there were many structural fractures and shocks in Turkey. Standard unit root tests may be insufficient to consider the structural breakages and shocks in question. Therefore, the stationarity of the series was tested using Zivot-Andrews (1991) and Lee-Strazicich structural unit root tests, which consider structural fractures and shocks.

Table 6 shows Zivot-Andrews (1991) single break unit root test results. When using the Zivot-Andrews test, the series were analyzed in three different ways: "fixed", "trend "and "none". According to the test results, the HDI and AGR_GDP variables are stable in the "intercept" and "trend" options, while the LN (TEMP), LN (PREP) and INVEST_GDP variables are stable under the "both" options. The LN (HUM) variable was found to be stable under all options.

Table 6: Zivot-Andrews Single Break Unit Root Test

	Intercept		Trend		Both	
	Statistic	Break	Statistic	Break	Statistic	Break
HDI	-6.235***	2010	-5.032**	2009	-5.0126	2008
AGR_GDP	-4.415***	1998	-3.975***	2004	-	-
LN(TEMP)	-	-	-	-	-6.913**	2002
LN(PREP)	-	-	-6.040	2012	-6.524***	2009
INVEST_GDP	-3.424*	1998	-3.006	2000	-3.985***	2004
LN(HUM)	-5.186***	1999	-5.119***	2014	-5.699**	1999

****, ** and * represented significance at the level of p<=0.01, p<=0.05 and p<=0.10.*

The maximum latency length was selected as "4" when analyzing the series.

Table 7 shows LM double break unit root test results. While the LN (PREP) variable was found to be stable under the double break, other series were found to be stable under one and two breaks. As a result, all variables used are stable at the level and do not contain a unit root problem.

Table 7: LM Double Break Unit Root Test

	One Break		Two Break	
	Statistic	Break	Statistic	Break
HDI	-3.837***	2000 (3)	-3.566**	1998:2000 (3)
AGR_GDP	-3.873***	2009 (6)	-3.408*	2005:2009 (6)
LN(TEMP)	-3.724**	2000 (6)	-3.883**	2000:2013 (6)
LN(PREP)	-3.106	2000 (7)	-4.186***	2000:2002 (0)
INVEST_GDP	-4.474***	2010 (4)	-4.457***	2005:2010 (4)
LN(HUM)	-4.563***	2017 (1)	-4.497***	2010:2017 (1)

****, ** and * represented significance at the level of p<=0.01, p<=0.05 and p<=0.10.*

The maximum latency length for the HDI and AGR_GDP variables is selected as "6" and "8" for other variables. The "t" test (critical value) for the lag was selected as "1.645".

The econometric relationship between variables was analyzed using the OLS estimator after it was determined that the series were stable in their level values. The OLS estimator results are given in Table 8. The annual average temperature change and the impact of precipitation on sustainable development, which are indicators of climate change, were found to be positive and meaningful. The effect of humidity rates on sustainable development was found to be negative and meaningful. In addition, the effect of capital formation and constant C on sustainable development is positive and meaningful. Since structural fractures were detected in the first model, the DUMMY variable is included in the model. The DUMMY variable was found to be significant (p<=0.01). In the second model, the effect of annual average temperature changes and precipitation on the added value of agriculture, forestry, and fisheries from climate change indicators was negative and significant, while the effect of humidity rates on the dependent variable was found to be positive and significant. The effect of capital formation on the added value of agriculture, forestry, and fisheries is meaningless. F test statistics show whether the models made sense. The ADJ. R2 test, which shows the ratio of explanatory variables to explain the variation occurring in the dependent variable, was found to be 88% for the first model and 74% for the second model. The fundamental assumptions of OLS models are autocorrelation, heteroscedasticity, normality, and the absence of model-building problems. It has been determined that there are no such problems for both predicted models.

The Jarque-Bera, Breusch-Godfrey, BPG, and Ramsey-Reset tests represented normality, autocorrelation, heteroskedasticity, and model-building tests, respectively.

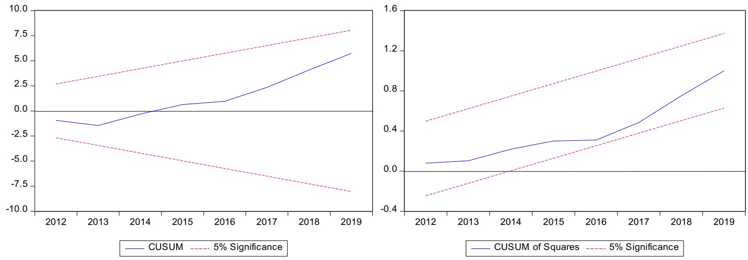
CUSUM and CUSUMSQ tests showing the stability of long-term coefficients are given in Figure 4. It can be said that the coefficients for both models are stable, there is no structural break.

Table 8: OLS Equation

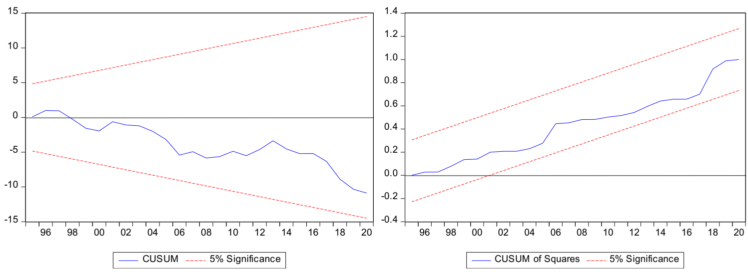
	HDI is a dependent variable (Model 1).			AGR_GDP is a dependent variable (Model 2).		
	Coeff.	**Std. Error**	**Prob.**	**Coeff.**	**Std. Error**	**Prob.**
LN(TEMP)	0.317	0.104	0.005***	-17.424	6.955	0.018***
LN(PREP)	0.150	0.058	0.017***	-9.663	3.825	0.018***
INVEST_GDP	0.003	0.002	0.083*	-0.182	0.117	0.132
LN(MOIS)	-1.125	0.258	0.000***	99.567	74.294	0.000***
C	3.458	1.050	0.003***	-290.853	74.294	0.000***
DUMMY	0.076	0.015	0.000***			
F-Statistic	46.186***			22.721***		
Adj. R^2	0.886			0.743		
Jarque-Bera Prob.	0.835			0.464		
Breusch-Godfrey Prob.	0.104			0.440		
BPG Prob.	0.678			0.208		
Ramsey-Reset Prob.	0.115			0.085		

****, ** and * represented significance at the level of p<=0.01, p<=0.05 and p<=0.10.*

Figure 4: CUSUM and CUSUMQ Tests



Model (1)



Model (2)

The dynamic relationship between the variables was examined by using the VAR model, impulse-response, and variance decomposition analyses. The VAR model lag length is given in Table 9. Akaike, Schwarz, and Hannan-Quinn's information criteria were used to determine the delay length. The appropriate lag length was selected as "1" for the first model and as "2" for the second model.

Table 9: VAR Model Lag Length

Model 1						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	122.8488	NA	1.52e-10	-8.417772	-8.179878	-8.345046
1*	228.2698	165.6616*	5.03e-13*	-14.16213*	-12.73477*	-13.72577*
2	250.0763	26.47927	7.64e-13	-13.93402	-11.31719	-13.13403
Model 2						
0	13.71331	NA	3.77e-07	-0.600918	-0.365177	-0.527087
1	73.88081	95.43811*	3.44e-08	-3.026263	-1.611819*	-2.583277*
2*	103.0136	36.16482	3.06e-08*	-3.311282*	-0.718134	-2.499140

"" represents the appropriate lag length.*

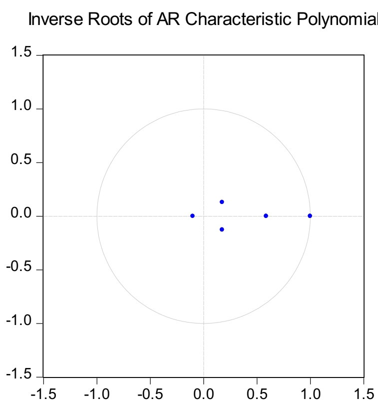
It is very important that there are no autocorrelation, heteroskedasticity, and normality problems in the predicted VAR models. The VAR model diagnostic test results are given in Table 10. The problem of autocorrelation, heteroskedasticity, and normality has not been identified for both models.

Table 10: VAR Model Diagnostic Tests

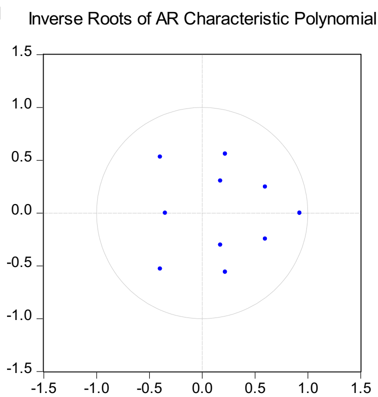
Model 1						
Null hypothesis: No serial correlation at lag h						
Lag	**LRE* stat**	**DF**	**Prob.**	**Rao F-stat**	**DF**	**Prob.**
1	21.96364	25	0.6378	0.860292	(25, 53.5)	0.6519
2	26.33182	25	0.3901	1.068844	(25, 53.5)	0.4069
Jarque-Bera Prob.		0.988				
Heteroskedasticity Test (χ^2)		0.125				
Model 2						
Null hypothesis: No serial correlation at lag h						
1	33.74452	25	0.1135	1.492776	(25, 34.9)	0.1354
2	29.70686	25	0.2355	1.252083	(25, 34.9)	0.2659
3	34.99874	25	0.0882	1.571904	(25, 34.9)	0.1073
Jarque-Bera Prob.		0.617				
Heteroskedasticity Test (χ^2)		0.592				

The eigenvalue stability graphs showing the stationarity of the estimated VAR system models are given in Figure 5.

Figure 5: VAR Model AR Root Graphs



(Model 1)



(Model 2)

The results of the analysis of variance decomposition are given in Table 11. 100% of the variance change in HDI, which represents sustainable development in the first period, was caused by it. In the second period, 80% of the variance change in sustainable development was caused by itself, 12% was caused by the amount of precipitation, 3% was caused by the humidity, and 1.605% was caused by average annual temperature changes and capital formation. By the tenth period, 60% of the variance change seen in the sustainable development variable was due to itself, 15% was because of the amount of precipitation, 13% was because of capital formation, 6.559% was due to average annual temperature changes, and 3.745% was because of humidity. 100% of the variance change in the added value of agriculture, forestry, and fisheries in the first period was caused by it. In the second period, 90% of the variance change seen in this variable was due to itself, 9% was due to capital formation, and the remaining proportion was because of other variables. In the tenth period, 59.980% of the variance change in the added value of agriculture, forestry, and fisheries was caused by itself, 14.677% by the amount of precipitation, 11.490% by humidity, 8.259% by the formation of capital, and 5.591% by the average annual temperature changes.

Table 11: Variance Decomposition Analysis

Variance Decomposition of HDI						
Period	S.E.	HDI	LN (TEMP)	LN (PREP)	INVEST_GDP	LN(HUM)
1	0.003	100.000	0.000	0.000	0.000	0.000
2	0.006	80.030	1.605	12.812	1.605	3.947
3	0.008	74.315	1.921	15.140	4.057	4.564
4	0.009	70.519	2.817	15.814	6.347	4.500
5	0.011	67.707	3.745	15.959	8.257	4.329
6	0.012	65.560	4.555	15.937	9.781	4.165
7	0.013	63.898	5.221	15.867	10.986	4.026
8	0.014	62.595	5.761	15.787	11.942	3.913
9	0.015	61.557	6.200	15.712	12.708	3.821
10	0.016	60.719	6.559	15.645	13.330	3.745
Variance Decomposition of AGR_GDP						
Period	S.E.	AGR_GDP	LN (TEMP)	LN (PREP)	INVEST_GDP	LN(HUM)
1	0.820	100.000	0.000	0.000	0.000	0.000
2	1.246	90.471	0.074	0.187	9.211	0.054
3	1.512	79.158	1.129	5.431	14.089	0.191
4	1.680	71.457	3.062	10.243	14.808	0.428
5	1.847	64.409	4.553	12.576	12.798	5.661
6	2.003	60.223	4.529	13.609	11.015	10.621
7	2.113	59.590	4.421	13.990	10.073	11.924
8	2.205	59.757	4.690	14.267	9.353	11.931
9	2.287	59.890	5.148	14.539	8.742	11.678
10	2.356	59.980	5.591	14.677	8.259	11.490

5. Conclusion

Researchers that try to analyze and predict the future effects of climate change have shown that Turkey and similar developing countries will be more affected by climate change than developed countries if no adaptation preparation or mitigation policy is implemented. Increasing losses in future economic growth and output rates because of the climate can lead to a decrease in the well-being of individuals and a slowdown in development. This will lead to a further widening of the development gap between developing countries and developed countries. Because of the increasing climate in Turkey, especially in the last decade, climate adoption prepared action plans and carbon reduction targets covering the near future have been set. This research examined the extent to which climate change affects the country's level of sustainable development. The results showed that the increased temperature and precipitation had a positive and meaningful effect on the development level of the country. The effect of humidity rates on sustainable development rates was found to be negative and significant. Variance decomposition analyses have shown that climate indicators significantly explain the change in periodic variation in development. The findings showed that temperature ratios and precipitation have an extremely strong interaction with sustainable development. Agriculture is the main sector directly affected by climate change. The study also analyzed the effects of climate change on Turkey's agricultural sustainability within the framework of sustainable development. Accordingly, the increased temperature and precipitation negatively affected the added value of agriculture, forestry, and fisheries, while humidity rates had a positive and meaningful effect. Agricultural land has an important place in Turkey. However, the share of the added value of agriculture, forestry, and fisheries in the country's GDP has decreased since the seventies. However, the weight of the tourism sector, which is closely related to rising temperatures, has increased in the economy and has been a driving force for the development of the country. During this period, positive developments in the services and industrial sectors increased the prosperity of the country and the middle class grew. Therefore, the negative effects of the climate on the agricultural sector have not undermined Turkey's sustainable development for now. However, as the recent global pandemic has shown, the agricultural sector and food security have an important place in the future of nations. Especially in the long term, rising temperatures can lead to the spread of drought in the country, causing serious agricultural problems, increasing the sensitivity of other sectors to the climate, and increasing economic costs. In addition, the country's water quality may deteriorate. Therefore, it may adversely affect the long-term sustainable development of Turkey. Therefore, it is very important that adaptation preparation and mitigation policies that will keep the climate under control in the country are implemented uncompromisingly and that action plans that will include them in the near future are implemented.

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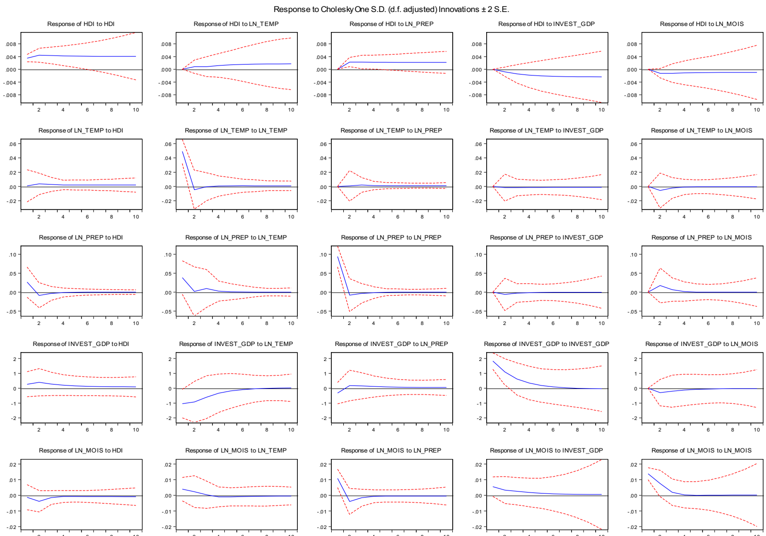
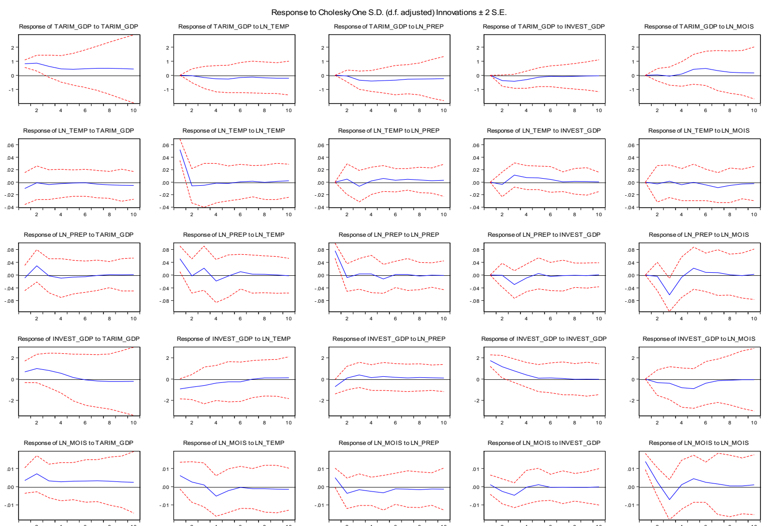
Appendix

Figure 1: Impulse-Response Analysis



(Model 1)



(Model 2)

PART II

MACRO ECONOMIC POLICIES

5

The Experience of Turkey's Narrow Corridor

Yıldırım Beyazıt Çiçen (Gumushane University)
ORCID: 0000-0002-3425-280X
ybcicen@gumushane.edu.tr

Abstract

In this study, the outlines of the book "Narrow Corridor: States, Societies and the Fate of Freedom" are summarized, and the process of Turkey's narrow corridor experience is investigated in historical periods. The study describes the structure of the state and society's mutual dynamic development in different periods and explains whether these developments extend freedoms and how they affect the economic indicators of the relevant periods. When examining the period from the republic's foundation to the present, the power of the state and society changes in different periods. Turkey has not entered the narrow corridor, despite the considerable improvements achieved in the early 2000s. In conclusion, inferences have been made about how Turkey can enter the narrow corridor and stay there.

Keywords: Narrow Corridor, State, Society, Liberty, Turkey.

JEL Codes: D02, O43, H70

1. Introduction

In their book "Why Nations Fail: The Origins of Power, Prosperity, and Poverty" released in 2012, James A. Robinson and Daron Acemoğlu examined the impact of institutions on the rate of growth and quality of economic development. The book explores how institutions develop, their dynamics, and the challenges that many countries confront in improving their institutions. The same authors' 2019 book, "Narrow Corridor: States, Societies, and the Future of Freedom" contributes to the existing discussion by presenting a clearer understanding of the subject.

In their recent book, Acemoğlu and Robinson focused on how civil liberties are practiced and sustained. According to the book, freedom is "a condition free of violence, intimidation, and other unpleasant behaviours (no dominance)". The state and laws are required to establish freedom, and society must control the state's action. Therefore, the necessity for society to be active has arisen (take part in politics, protest when necessary, and overthrow the government through elections). Since achieving freedom is a process, the authors call it a "corridor". The phrase "narrow corridor" refers to the difficulty of entering and staying in the corridor. A state must be capable of preventing violence and enforcing laws in order to enter the narrow corridor. However, there is a constant struggle between the state and society. The state and society will compete or cooperate in this narrow corridor by ensuring mutual dynamism and balance. Developing freedom, democracy, and institutions in the narrow corridor is a long process. Democracies that provide economic growth, peace, and political stability breed their support for democratic institutions by the society (Acemoğlu and Robinson, 2020: 11-15; Acemoğlu et al., 2021).

Beyond a negative freedom approach that limits itself with the rule of law, neo-institutionalism emphasizes the state's capacity to ensure positive politics and freedom. State capacity, which plays a strategic role, refers to the government's ability to read society's needs and conditions and improve political solutions of domestic and international market forces. Along with improving state-of-the-art political solutions, the bureaucracy should also implement these policies and persuade businesses and society to support them. A high level of institutionalized interaction and dialogue should also be exhibited among the state elites and autonomous centers of power within civil society (Öniş, 1991).

Furthermore, because freedoms are related to the political environment, state structure, and government policies, every country has a unique experience with economic growth. Deterioration of political institutions is frequently observed in developing countries. Effective political institutions are required for a democratic and stable government and long-term economic growth. For this reason, social scientists and policy analysts must conduct research and make inferences about strategies for institutional development (Rodrik, 2007).

The book's central argument is that explaining how institutions protect inclusive democratic freedom and transform economic indicators into positive indicators will not be accomplishable without considering a country's historical background and revealing the relationship between state and social power. In addition, institutions change and develop where a society participates in politics. As a result, freedom is both a result of institutions and a contributing factor to the evolution of institutions. This chapter explains the structure of the mutual dynamic development of the state and society starting from the foundation of the Republic of Turkey[1]

1 For the analysis of the foundation of Turkey and the different periods, Pamuk (2019) was taken into account.

and how this development sets the ground for freedoms and economic growth. Turkey will be perused by periods within the framework of institutions and rules.

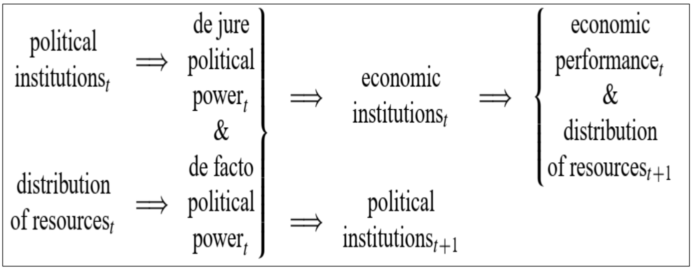
It is thought that this book chapter will contribute to the literature. Because the narrow corridor argument is a path-breaking novelty in economics and revives the institutional economics with contemporary debates. However, the narrow corridor argument lacks rich case studies of countries and regions. The most significant contribution of this study is adapting the narrow corridor formula to concrete modern Turkish historical periods. Studies in the literature deal only with the structure of the state or society. However, there was no study conducted with the idea of Turkey approaching or moving away to the narrow corridor in the relevant periods covered in the study.

The first section will examine the relationship between institutions and economic performance. The types of Leviathans and critical concepts will next be reviewed. Then, Turkey's experience of the narrow corridor will be explained in terms of periods. To this end, the foundation period of The Turkish Republic, then The Second World War, and the transition to a Multi-Party System is first discussed. The period after 1960 will then be explored, with a focus on coup d'états and economic problems. After that, the 2000s and the Justice and Development Party (JDP) period will be analyzed. Finally, it is concluded by drawing fundamental inferences.

2. The Relationship between Institutions and Economic Performance

Recent literature has shown that institutions are the primary cause for the differences in countries' economic growth. Therefore, to answer such questions as why institutions are of varying quality in different countries and how institutions evolve is critical for economic performance (Rodrik, 2000). As shown in Figure 1, there is a relationship between institutions and economic performance in the long run. Institutions that emerged in the past determine the current economic performance and resource allocation, which continues in a cycle.

Figure 1: Institutions and Economic Performance

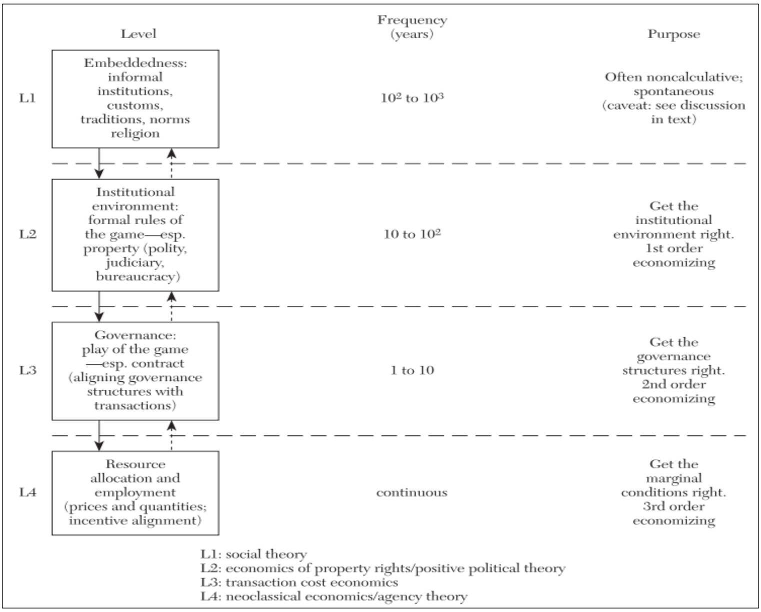


Source: Daron, Acemoğlu, Simon Johnson, James Robinson. 2005. Institutions as a Fundamental Cause of Long-run Growth. Handbook of Economic Growth. c.1, 389-396.

Institutions are the rules of the game. The most critical role of institutions is to reduce uncertainty by providing a stable structure among society. Institutional change shapes the transformation of societies and plays a crucial role in our understanding of historical change. Institutions are divided into informal and formal institutions. Informal institutions are unwritten rules and are formed by culture, traditions, norms, and religion. These institutions constitute the environment in which society has evolved over the centuries. Formal institutions are written and comprise political and economic rules and contracts. While political rules define the state's basic decision-making structure and control mechanism, economic rules define property rights. By relying on policy rules, economic performance can be improved. On the other side, the discretionary policy will not maximize the social function (North, 1990: 36-53; Kydland and Prescott, 1977; 473-475). Formal institutions change more rapidly than informal institutions.

Figure 2 illustrates the transition between informal and formal institutions. With the formation of institutions, the quality of governance is determined, and resource allocation is procured. The book Narrow Corridor contributes to the literature by explaining the relationship between formal and informal institutions. The book explains the relationship between formal (state) and informal institutions (society) through the factor of balance and the political and economic consequences of this balance.

Figure 2: Economics of Institutions



Source: Oliver E. Williamson, 2000. The New Institutional Economics: Taking Stock, Looking Ahead. Journal of Economic Literature. c.38. s.3, 597.

3. Types of Leviathans

Social welfare loss due to the state's uncontrollable expansion damages society. Fundamental rights and freedoms, particularly individual rights of life and property, may be constantly and easily violated in such a Leviathan land. This structure is known as the "Despotic Leviathan". In a despotic state, decisions are made without consideration for society's requests. Policies can be implemented peacefully or violently. As an example, China can be cited. Although the Despotic Leviathan establishes a powerful state, it oppresses and dominates society. Despotic Leviathan has the property of blocking the cage of norms that emerges in stateless societies (Paper Leviathan). In the absence of government institutions, norms protect against violence (Hobbes, 1960).

Nevertheless, norms limit freedoms by enclosing them in a cage at the same time. Conflicts between individuals cannot be resolved. Norms also result in deep hierarchies and inequalities. However, people accept the norms and unequal forces that limit freedoms because they mitigate the suffering caused by the war (Acemoğlu and Robinson, 2020: 37-43; Aktan, 2021: 4-5).

A state of law whose power and authority are limited by rules and institutions and bound by the constitution can ensure peace, freedom, and security and promote economic prosperity. Thus, a state that enforces laws, controls violence, settles disputes, and provides public services is required. Furthermore, society must maintain control over this state. The "Shackled Leviathan" is a state that responds to its citizens' requests and desires, weakens the cage of norms, expands the area of freedom, and is accountable to society.

Under these circumstances, the state is powerful, but there is an influential society against it, and the state has to adapt to the society. When citizens disagree with the state, they organize demonstrations, and when they do not approve their actions, they vote out elected legislators (Acemoğlu and Robinson, 2020: 47-48; Aktan, 2021: 4-5).

Compared to the Despotic Leviathan, the Shackled Leviathan develops a more potent and profound state capacity. However, under the rule of the Despotic Leviathan, economic prosperity rises as well. Even so, this prosperity is limited and rife with inequalities. Unsteady states cause a distorted evolution of society's power and capacity, and the state remains unaccountable (Acemoğlu and Robinson, 2020: 49-52).

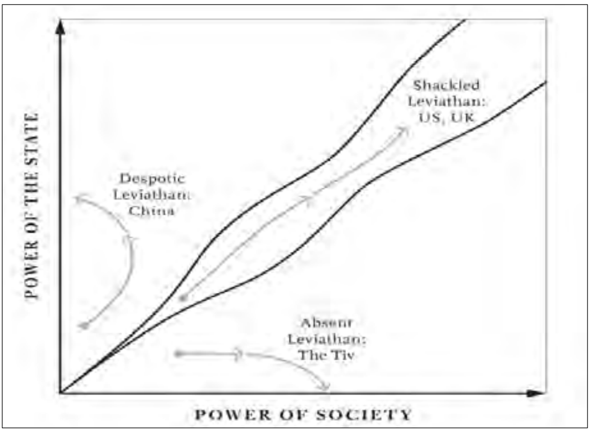
Historical evidence suggests that economic development is faster in countries with powerful state institutions, backed by empirical evidence (Hanson, 2014). In this regard, having a good understanding of the Shackled Leviathan is essential; therefore, the following section will focus on this concept.

3.1. Shackled Leviathan and Narrow Corridor

A Shackled Leviathan emerges when a balance is struck between the state's power and society's capacity to control it. This structure correctly resolves conflicts, prevents the yoke, and establishes the essential foundations of liberty. People believe that they can control, trust, and cooperate with this Leviathan, so they allow it to increase its capacity. As a result, freedoms are expanded by breaking the constraints of various social norms (Acemoğlu and Robinson, 2020: 88).

The power of society and the state creates a narrow corridor for the Shackled Leviathan in Figure 3. The struggle to gain strength between the state and society continues to progress decisively and remains in the narrow corridor. Power of the state signifies the capacity of the state, its sovereignty over the society, the functioning of judicial institutions and bureaucracy. The state's power also includes economic capacity, regulation, and the like. For society to be strong, it must act as a unit, coordinate its actions, and keep the political hierarchy in check. Here, the Red Queen effect is the delicate balance between state and society. As a result, absolute freedom, which is unhindered in political, economic, and social areas, emerges and develops purely in this narrow corridor. Imbalance in the power of the society or the state drives the structure to be Despotic or Paper Leviathan.

Figure 3: The Evolution of Despotic, Shackled, and Paper Leviathans



Source: Acemoğlu and Robinson (2020: 89).

The dynamism of how institutions evolve is represented by arrows in the figure. The arrows in the middle show that society and the state are both getting stronger simultaneously. At the starting point of statelessness, arrows show that society is moving away from the narrow corridor, and the Absent Leviathan is to be formed. When the power of the society is limited, arrows lead us to the Despotic Leviathan because those who have political power tend to maintain the political institutions that give them that political power (Acemoğlu et al., 2005: 4). Because their starting positions differ, not all countries follow the same path to enter the narrow corridor.

The United States of America is a Shackled Leviathan case. For 230 years, the state has been developing its capabilities. Responding to society's requests, collaborating with it, and being accountable has ensured the shackled structure does not worsen (Acemoğlu and Robinson, 2020: 74-75). On the other hand, in the Trump era, American intellectuals worried about losing democratic traditions, erosion of institutions, and the rise of a populist despot. The book is a response by Acemoğlu against the Trump period. Acemoğlu has been one of the key intellectual figures of post-Trump democrat restoration in the USA. His emphasis on the regulation of technology companies and welfare state 3.0 is also a part of this restorative role.

Shackled Leviathan will establish property rights in a balanced and libertarian environment. Regulatory institutional structures can be formed as the political and economic elites are supervised. So, laws will be enforced, oppression and violence will be controlled, conflicts will be resolved, and public services will be provided. Therefore, the incentives of economic actors will increase, and new economic opportunities will emerge. As a result, economic performance will increase with raised productivity. This kind of growth is more inclusive. The prosperity brought about by increased economic growth will benefit the entire society (North, 2010; Robinson and Acemoğlu, 2012).

The democratic legitimacy of government operations and political participation positively and significantly impact corruption perceptions (Abreu and Gomes, 2021). As a result, public policy initiatives to create social opportunities are required. Today's wealthy countries carried out notable public investments in various areas such as education, healthcare, and land reforms in the past. Because these social opportunities were widely shared, most of the population could participate in the economic expansion process (Sen, 2014: 545).

4. The Experience of Turkey's Narrow Corridor

Institutions and institutional change gained significance in the 2000s with the contributions of North. Afterward, Acemoğlu carried the argument of strong institutions into the center of respectable academic economist circles. This argument relates closely to recent institutional and economic developments in Turkey.

It is aimed to historically explain Turkey's experience of entering the narrow corridor in this section. The coup d’états and economic crises the country has gone through and the specific periods during which the state and society gained strength and the reasons behind it will be examined, emphasizing the period of the transition to the market economy after 1980.

4.1. Republican Period, 1923-1947

In the transition from the Ottoman Empire to the Republic, the central government continued to be stronger than society and the private sector.

As well as agricultural structures, the republican period also preserved the openness to foreign trade and capital (Pamuk, 2018: 163; Çakmak Şahin and Yurt, 2010: 447-448). New institutions and policies constituted based on the preferences of the government in the first years of the republic were implemented. Reforms made by the army and bureaucracy were strict. After this period, the center of power was the Republican People's Party (RPP), founded by Atatürk. RPP remained a political monopoly for a while (Huntington, 1965: 27). While the RPP modernized the economy and society, it gave its leaders and allies unbridled power and wealth. During this period, reforms such as emancipation of women, modernization of bureaucracy, and industry support increased society's freedoms and the state's capacity. These reforms, however, did not place Turkey in a narrow corridor. Because many reforms, such as the switch to the Latin alphabet, clothing revolution, and reorganization of theological institutions, were implemented without consultation with the society (Acemoğlu and Robinson, 2020: 486-487). Apart from that, the concentration of political and economic power in a few officials resulted in a loss of economic control (Pamuk, 2019: 113).

The state played a significant role in economic development, and a more introverted, state-led protectionist development strategy was adopted. The private sector was heavily reliant on the state and political power in the 1930s. Planned industrialization steps were taken under the state's leadership during this time, and five-year progress plans were developed. Statism gained traction after the devastating effects of the Great Depression in 1929. Growth was observed in the short and medium-term (Pamuk, 2012: 212-215; Keyder, 1987: 105-106).

In the period of 1923-1947, Turkey did not enter the narrow corridor. State-led development played a significant role in development, but social power was not increased. In addition, since the Turkish state was founded under military leadership, coup d'états have continuously occurred since then. While this understanding prevented the strengthening of state capacity, at the same time, social capacity remained limited.

4.2. The Second World War and Transition to Democracy, 1947-1960

The transition to a multi-party political system and the transformation of institutions following World War II was a watershed moment. The private sector grew stronger during the post-World War II period of import substitution, resulting in a more evenly distributed income distribution. Income disparities decreased as the political regime became more receptive to the demands of peasants and workers. Previously under the single-party regime, worker organization was not encouraged (Pamuk, 2013: 313).

After the Second World War, considerable political and economic changes were observed. The discontented masses of people, mainly small and medium-sized farmers, brought the Democrat Party (DP) to power due to the single-party period's famine, poverty, and hardships (Oktar and Varlı, 2000: 6). The transition to the multi-party system brought essential policy changes in the field of economy as well as in the political field. These policies sought to reduce the role of the public in the economy and to implement liberal policies that prioritize the private sector. In the post-1950 period, the political regime provided the peasants and urban workers with more organizational opportunities. DP was in power; however, the perspective of non-strike trade unionism persisted (Mahiroğulları, 2001: 165-166).

According to many scholars, import substitution industrialization began in the 1960s. Pamuk argued that it started in the second half of the 1950s under DP. In both perspectives, the first half of the 1950s was characterized by a liberal experiment of integration into the world economy through agricultural exports, the import of agricultural inputs like tractors and fertilizers, and investment in transportation and energy infrastructures to increase agricultural productivity. The rural majority of society supported this liberal policy of Bayar and Menderes. A large part of rural society criticized the statist policies of İnönü, which prioritized industrialization and neglected agriculture. In addition, strict economic policies and wartime inflation decreased the popularity of statist industrialization policies. Keyder (1987) labels the period 1950s as "market populism". This debate of market populism is a direct example of the interplay of social and state powers.

Regarding this period, the Beveridge report, published in England in 1942, is particularly noteworthy. Beveridge proposed leading ideas in social security in this report, with the goals of preventing poverty, reducing unemployment, establishing a national health system, ensuring that everyone has a minimum standard of living, and expanding the economy (Beveridge, 1942). The necessity of a comprehensive social insurance system and minimum living standards to ensure the country's social welfare was emphasized. The report established a far more ambitious social security agenda than had previously been accepted, and it had a significant impact in other countries along with the United Kingdom (Abel-Smith, 1992). Another report concerning Turkey was the Thornburg Report. As part of the Marshall Plan, the American Delegation provided this report that summarized the general situation of Turkey in those years. According to the report, there was a lack of qualified experts in Turkey, and merit should be given priority to ensure well-trained managers and expert personnel, and the wage system should improve in this area. A series of suggestions on the backwardness of agriculture and the misuse of industrial production methods were presented. The report also criticized the investments made with the help of the USSR, emphasizing that the USA should be supported instead (Thornburg, 1949). The mindset of a social welfare state that the reports point to was not seen until the 1980s.

The transition to the multi-party system has brought about a positive change in governance. This development also had reflections on social power. Compared to the previous period, Turkey is closer to the narrow corridor. However, neither the state nor society had the power capacity to enter the narrow corridor in this period.

4.3. Coup D'états and Economic Crisis, 1960-1980

Turkey adopted an expansionary monetary and fiscal policy after the 1950s. High inflation and a foreign exchange shortage were observed in the mid-1950s. Consequently, economic activity was disrupted, and many consumer and investment goods were in short supply. Furthermore, while the budget deficit was lower than expected in the early 1950s, it grew in the following years. As a result, the DP abandoned the liberal policies it had envisioned, and the state-run planned economy was reinstated after 1960. A more interventionist stance was taken in the economy, and income distribution deteriorated due to the rising public debt (Pamuk, 2012: 232; Coşar, 2010: 185-191).

In 1960, the army intervened in the DP, which introduced the peasants to politics and strengthened traditionalism, with the argument of modernization. The DP was disbanded, and many key leaders were sentenced to death. The army and bureaucracy remained powerful after 1960. Soldiers intervened in the political system and made coup d'états in 1960, 1971, 1980, and a note in 1997, which, they believed, were the years the regime was in jeopardy. The army exerted pressure on the national will by using its traditional and institutional power. After a brief period of one-two-party rule, Turkey has transitioned from a relatively stable one-party system to a military and multi-party system. This was a common state syndrome in which mobilization surpassed institutionalization. The coup d'états hampered the development of democracy and prevented the establishment of a pluralistic and transparent civil administration. (Huntington, 1965: 421).

In the 1970s, political unrest escalated. Economic policies were shaped in response to the private sector's short-term demands and the day-to-day circumstances of the economy. This is an example where social forces, such as businessmen, are violating narrow corridor. The sectors to be protected were chosen based on the needs of the private sector and the political clout of powerful groups. As a result, a low-tech industrialization process emerged. (Pamuk, 2012: 255-256). Polarization between the parties, terrorist incidents, and unsolved murders occurred during these years. Turkey was dragged into another coup d'état in 1980 due to these situations. (Kerimoğlu, 2020: 156). Individual rights and freedoms were suspended due to military interventions, which changed institutional structures and affected economic performance (Beşkaya and Manan, 2009: 73).

On the other hand, to solve this problem, Japan and Korea have solid planning agencies that can govern business with a logic of a developmental state (Öniş, 1991: 125). Similarly, five-year planned development policies were adopted in Turkey in the 1960-1980 period. Although the First Five-Year Development Plan was effective in industrialization and development, the Second Five-Year Development Plan failed due to the exchange rate crisis and devaluation in the 1970s. The Third and Fourth Five-Year Development Plans also failed due to the oil crisis and political confusion. When the outputs of the development plans are examined, a general failure is observed. Thus, the interventionist state and welfare state policies are questioned. In this period, due to the oppressive state structure and weakening social power, Turkey moved away from the narrow corridor.

4.4. Transition to Market Economy, the 1980s and 1990s

In 1980, Turkey's political and economic institutions underwent yet another transformation. While the armed forces gained more power because of the coup d'états in 1980, political institutions and democracy were not strengthened. The 1982 Constitution was also a coup d'état constitution, laying the groundwork for tutelage and prohibitionist institutional ideas. During this time, legal issues such as privatization cancellations and party closure decisions were commonly observed. In the 1980s, all political parties were shut down, and the leaders like Ecevit, Demirel, Türkeş, and Erbakan were banned from politics. The ban was lifted in 1987 following a referendum. The bans exacerbated political polarization and instability. At the same time, significant restrictions on freedom of thought and association were imposed (Atiyas, 2009; Ergil, 2000: 56).

A closed, interventionist, and import substitution-based industrialization was replaced by pro-market and export-oriented neoliberal policies after 1980. The role of state and local governments in the distribution and accumulation processes, on the other hand, did not diminish. During this time, the military junta prohibited trade union activity. The bureaucracy's mindset of distributing welfare to adherent groups in the market persisted after 1980, as it had in the early periods. Arbitrary procedures, privileges, and corruption of the 1980s, combined with the political instability of the 1990s, resulted in economic crises one after another (Mert, 2003: 16-18; Pamuk, 2010: 20).

Political unrest escalated in the 1990s. Political instability weakened institutions, and the state's power remained limited during recessions. Throughout the 1990s, there were public deficits, inflation, and devaluations. There was an increase in the informal economy and income inequality. There were no dynamics that would increase investments and economic productivity in this period. The public lost faith in the government because of its inability to implement consistent policies. As a result, the military and financial powers increased their influence over politics, and the link between politics and society was severed. (Cizre-Sakallıoğlu and Yeldan, 2000: 506). Welfare Party politicians won local elections and several municipal victories in the 1990s. In 1998, the Constitutional Court disbanded the Welfare Party. In this period, the JDP founded by the Welfare Party members rose after it was founded in 2001. Widespread corruption and mismanagement in the 1990s caused the votes of center-right parties to shift to the JDP (Özbudun, 2006).

This period was paradoxically two-sided. On the one hand, the state became authoritarian and limited civil rights. The state's institutional power on economic life started to diminish. In other words, the 1980s was a period of deregulation. The state gained power in a brutal sense but lost power in a bureaucratic sense and state capacity to implement economic policies. In the framework of Acemoğlu, the strong state is not an oppression performer but a strong policymaker and regulator.

4.5. The 2000s and the Single Party Period

In the early 2000s, Turkey had the opportunity to enter the narrow corridor. Turkey set out with the Despotic Leviathan under the rule of the army and bureaucracy. Following the economic crisis of 2000-2001, significant political reforms were implemented to improve the economy and encourage the European Union (EU) entry process. The JDP, which came to power in 2002, followed policies to strengthen democracy. The economic policies were developed for all segments of the private sector, the privileges given to specific segments were cut off. Institutional arrangements of the 2001 program, which were prepared in collaboration with the IMF and led by Kemal Derviş, were maintained. Many institutions, especially the central bank (CBRT), gained their independence. The enactment of harmonization packages within the framework of the EU target improved the freedoms of various segments of society. In addition, constitutional reforms were implemented to limit the army's power over civilians. As a result of the EU's support, military tutelage was reduced. Institutional arrangements and structural changes significantly influenced economic performance. Between 2002 and 2007, the Turkish economy grew rapidly, and inflation decreased.

Furthermore, investments have increased, unemployment and income inequality decreased, and financial markets deepened. Education and health are at the forefront of these investments. Before the global financial crisis, the economy's productivity and quality of growth were improved by establishing a competitive structure, an independent judiciary, and transparency. By contrast, the external debt started to rise in the 2000s, which would be problematic in the 2010s. External debt was used to finance household consumption, imports, construction, and finance rather than financing productive sectors. While Turkey has made progress toward entering the narrow corridor during this time, the necessary reforms, compromises, and coalitions have not yet been formed (Çiçen, 2019: 432-435).

The soldiers declared a memorandum in April 2007. Also, the Constitutional Court has launched an investigation to shut down the JDP. Although the JDP has not been closed, polarization between the party and the military-bureaucratic order has grown (Aydın and Taşkın, 2014: 477-480). In a healthy democracy, to shut down a political party because of different viewpoints or refuse to elect a President because his wife wears a scarf is not thinkable. Therefore, these can only be examples of democracy's flaws. Compared to the 1990s, the military overthrew the party in the Erbakan era, and the AKP has not closed shows that democracy developed in the early 2000s compared to the 1990s.

The upward trend experienced in the early 2000s could not be maintained. The global crisis was a period of recession for Turkey. The institutional and economic transformation could not be sustained after the global crisis. Because in this period, the goal of EU membership weakened, and JDP increased its dominance in power (Öniş, 2019: 13). Following the global crisis, the government established medium-term programs without being affiliated with the IMF. The attitude toward institutional independence has shifted during this period. The CBRT's independence, for example, has dwindled. In the public sector, transparency and productivity have declined.

Turkey's central bank independence is a good example regarding the importance of institutions. The central bank determines the country's monetary policy to ensure price stability and takes and implements related decisions. It thus occupies a vital role in the performance of the country's economy. Due to this critical function, central banks must be independent and structured so that political pressures do not influence them. In this way, the economy will become more stable. According to the Turkish Statistical Institute, after CBRT lost its independence after the 2010s, annual inflation in Turkey increased to 50% in January 2022, from single digits in the mid-2000s.

Furthermore, investments have been focused on specific sectors rather than capital goods. The economy is still growing after the global crisis, but not as qualified as before. Increased credit-based consumption expenditures were used to fuel the growth. Unemployment and social inequality also increased during this period (Gürkaynak and Sayek-Böke, 2013). Various economic problems that emerged at the end of the 2010s (high inflation, rapid depreciation of Turkish lira, and hot money outflow) resulted from the structural development of the Turkish economy in the early 2010s and the low quality of growth (Acemoğlu and Üçer, 2020). According to Transparency International's Corruption Perceptions Index, Turkey, which ranked 59th in the world in 2010, fell to 86th in 2020[2].

The Gezi protests took place in May and June 2013. People took to the streets in many parts of the world to make demands through protests. In Turkey, however, these types of protests are uncommon. The government responded to the demonstrations with harsh measures. The Peace Process came to a halt as freedoms were restricted. In 2015, there were two election processes. JDP stopped coalition negotiations and forced re-election between June and November 2015. After the replacement of prime minister Ahmet Davutoğlu with Binali Yıldırım, JDP and Nationalist Movement Party agreed on a referendum that prevents coalition. A military coup d'état attempt against the government occurred in July 2016. However, various segments of the society who believed in democracy united in their opposition to the coup d'état attempt. This was an encouraging sign of democracy. Although the coup d'état attempt failed, a state of emergency was declared throughout the country. Many members of the judiciary and bureaucracy were purged because of this process. Since the state of emergency process centralized all political power, restrictions

2 https://www.transparency.org/en/cpi/2020/index/nzl - Access Date: 22.09.2021

on freedom of the press and expression increased. As a result, freedom of thought and media became much weaker during the state of emergency. The state of the emergency process was made permanent for a time, which damaged democracy and weakened institutions (Taştan and Ördek, 2019). After the 2017 Turkish constitutional referendum, the country's form of government was changed to a presidential system. The first presidential elections were held in 2018, at which Recep Tayyip Erdoğan was elected president.

The presidential system, which was brought to eliminate the handicaps of the coalition period, could not provide an effective governance due to the failure of the necessary balance and control mechanisms. As a result, the rules are no longer binding, and predictability is reduced. This situation has increased economic fragility. Due to the loss of independence of economic institutions (CBRT, CMB, Banking Regulation and Supervision Agency, etc.), economic indicators such as exchange rate, current account deficit, inflation, unemployment, budget deficit, and risk premium were adversely affected.

5. Conclusion

Today, developed societies have partially succeeded in shackling Leviathan and creating constitutional rules and institutions of the state. On the other hand, Leviathan exists as a threat to freedoms in many countries with its unchecked power.

In Turkey, the state's power over society has remained relatively constant. In the last 60 years, political and economic institutions have seen significant improvements. Broader segments and higher participation shape today's institutions. However, significant problems and deficiencies exist in political and economic institutions. Institutions related to state intervention will be necessary to the Turkish economy in the forthcoming period, as in the past. Today, state interventionism in Turkey is still carried out not with long-term rules but with short-term knowledge and through individuals.

In order to strengthen society's power in Turkey, civil society, the media, and political parties must all participate more actively. In this context, solving conflicts and solidarity in society are also important. Fundamental rights, an indispensable part of democracy, have recently been ignored. Problems in law and judiciary persist. A more liberal constitution, a more participatory political regime, a more just and trustworthy judiciary that all segments of the society will adopt will support economic development in the medium and long term. These reforms are crucial for Turkey to enter the narrow corridor and stay there.

There are rises and falls in our history. The crises and coup d'états experienced in the republican period disrupted the balance between state and social power and limited the quality of democracy, freedoms, and economic development. In the 2000s, there were many discrepancies forks in the development of democracy and freedoms (the JDP closure case, the Presidential election, the Gezi demonstrations, the coup d'états attempt in 2016). These events have shifted the balance of state and social power while weakening institutions. The economy reflects the deterioration of these political institutions.

At this stage, to reshape the structure of the Turkish economy, it is necessary to establish a constitutional state of law whose authority and powers are limited by constitutional rules and institutions. Some steps that should be taken are to reform the institutional structure, ensure participatory democracy and the independence of the judiciary, expand the freedoms of expression and the press, strengthen property rights, increase investment and productivity, enhance opportunities of equality and entrepreneurship, and improve health and education policies which are the priority areas. The outcomes of these steps will be visible in the short, medium, and long terms. Individuals' and investors' positive perceptions of the country, both domestically and internationally, are critical at this stage. After 2000, for example, these steps were successfully implemented, and significant progress was made in terms of democracy, freedom, and economic prosperity. Turkey is currently confronted with both risks and opportunities. The actions mentioned above are required to rectify the worsening economic indicators because of the pandemic.

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6

How Does Trust in Government Affect Economic Growth and Happiness: Evidence from EU-12 Countries

Seyfettin Artan (Karadeniz Technical University)
ORCID: 0000-0003-4310-550X
artan@ktu.edu.tr

Pınar Hayaloğlu (Gumushane University)
ORCID: 0000-0001-7181-8801
pinarhayaloglu@gumushane.edu.tr

Selim Koray Demirel (Karadeniz Technical University)
ORCID: 0000-0003-3051-8700
skdemirel@ktu.edu.tr

Abstract

Trust, serves the basis of cooperation between individuals and institutions, thus affects the entire set of social interactions. For this reason, not only economists but also psychologists, sociologists, and philosophers also pay growing attention to the notion of trust and its impact. Recent findings show that trust has the ability to govern economic activities but also that different trust categories may have varying impacts. This study tests the impact of trust in government in EU-12 countries upon economic growth and happiness. Relying on static and dynamic panel data methods, the study focuses on the period of 2006-2020. The findings confirm that an increase in trust in government positively affects the economic growth and level of happiness, suggesting that policymakers may increase economic growth and level of happiness by improving trust without having to bear any costs.

Keywords: Trust, Trust in government, EU countries, Panel data analysis, Happiness

JEL Codes: O11, E02, O52, C23

1. Introduction

The role of trust in explaining the differences between growth rates in different countries has been extensively discussed in the literature. In a broad sense, trust refers to trust between individuals at the micro level, trust by the entire society in the state and government, in the state institutions, in the legal system and, in light of macroeconomic indicators, in the future direction of the economy. If we simply trust the institutions, legal system, state administration and future orientation of the economy and hold positive expectations in regards to the future, we will seek additional ways to produce or consume more.

As noted by Knack and Keefer (1997), people in societies experiencing a low level of trust spend less in order to avoid manipulation and exploitation in their economic interactions. Similarly, societies with high level of trust do not waste their resources on tax expenditures, bribery or private security expenditures. Interpersonal trust also leads to less expenditure by the state towards the protection of the people. In addition, societies with a high level of trust do not often require written contracts; in such societies, people do not have to explicitly indicate every unexpected state of affairs. To this end, societies with a high level of trust are less dependent upon official institutions in order to properly execute the contracts. Given that economic trust is relevant to expectations and attitudes on the overall state of the economy, it is reasonable for people to make their long-term decisions within economies experiencing fewer uncertainties and enhanced trust in economic performance and process. It should be noted that a decline in the economic trust will reverse this as lack of trust will undermine the innovation that serves as the main determinant of economic growth. Instead of focusing on innovative initiatives, the entrepreneurs may spend their time on checking whether or not the partners, employees or suppliers actually try to exploit them (Knack and Keefer, 1997: 1252-1253). In other words, trust bears importance in order to remove the barriers before the innovative activities.

A review of empirical studies on the economic impacts of trust (an inherently interdisciplinary concept) reveals that most studies have focused on the analysis of the impacts of trust upon economic growth (see Knack and Keefer, 1997, Zak and Knack, 2001, Dinçer and Uslaner, 2010, Bjornskov, 2012, Roth, 2009, Özcan and Bjornskov, 2012, Kasmoui et al., 2018). Academic studies on countries with reasonable data on economic trust demonstrate that economic trust is the main factor that positively affects primary macroeconomic indicators including economic growth. Only a few, on the other hand, including Hudson (2006), Kalsoom et al. (2017) and Suriyanrattakorn and Chang (2021), examine trust in the government and how it affects the primary macroeconomic variables. The existing literature confirms that an increase in trust for the government contributes to the effectiveness of the governments, equips them with the ability to orient the individual behaviors towards greater public utility, and makes them efficient in managing the economic expectations. However, it is possible to argue that these works fail to adequately analyze the economic outcomes of the trust in government by different country groups or different periods.

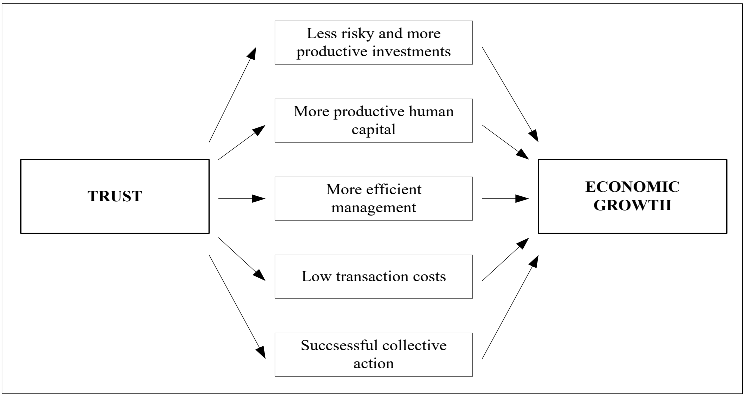
This study aims to analyze the impact of trust in the government in EU-12 countries upon economic growth and happiness by relying on static and dynamic panel data methods with reference to the period 2006-2020. The findings will serve as guiding principles for the policymakers seeking to improve economic growth and happiness without having to bear any costs. The introductory part is followed by an analysis of trust, trust in government, and the economic impacts of trust. The third part, focusing on empirical studies that analyze the economic impact of the trust, is followed by the fourth part presenting the econometric methods and findings. The final section presents the outcomes, results, and policy recommendations.

2. Trust, Trust in Government and Their Impacts

Trust is a complex and multidimensional concept, which has a strong impact on our daily lives. Contributing to the sustainability and stability of social interactions and encouraging integration through cooperation, trust may be characterized as the main assumption for the basis of cooperation between people. This leads us to conclude that trust is an integrated part of social life (Lekovic, 2012: 66). For this reason, trust is a phenomenon that ensures the coexistence of people in peace. Then what is trust? To put simply, trust refers to one's belief or expectation that others would act in compliance with expected behavioral patterns (OECD, 2017: 42). In other words, when person A trusts B, he/she believes that his/her needs or interests will not be in conflict with the B. And this expectation goes beyond good faith and takes the form of anticipation (Barbalet, 2019: 14). Based on this definition, two conclusions could be drawn: first, trust is focused on beliefs or expectations on the behavior of others. Second, it is focused on positive behavioral expectations. In other words, an individual is expected to be consistent in their acts and to exhibit constructive behaviors (OECD, 2017: 42). Given that an uncertain future will not foster the sentiment of trust (Luhmann, 2018: 15), these two conclusions minimize the uncertainties associated with the future (Bouckaert and Walle, 2001: 4). This means that trust represents expectations and forecasts on the positive behavioral patterns from an individualist perspective. From a societal perspective, on the other hand, it refers to alleviation of the uncertainties in the future. The reduction of the future uncertainties means positive outcomes generated by the high level of societal trust in economic terms.

Although not constituting the very basis of the social capital, trust is closely relevant to this notion (Fukuyama, 2001: 7). This makes the notion of trust very important for economic growth. Therefore, a high level of trust affects economic growth and development in many respects. Figure 1 shows how a high level of trust affects the economy.

Figure 1: High Level of Trust and Economic Growth

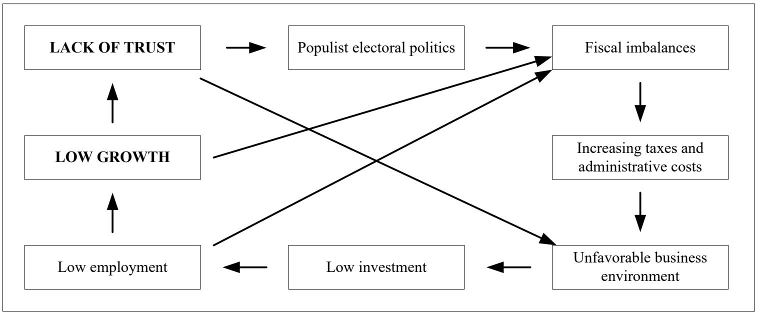


Source: Lekovic, 2012: 70

A high trust level encourages coordination among economic actors, leading to intense knowledge exchange and the emergence of more coordinated cooperation towards innovation. Additionally, an environment of trust minimizes future uncertainties and reduces the risks and threats to large investments. The improved level of trust also minimizes the process costs for the protection of private property rights and thus reduces the workload of the legal system. Therefore, by contributing to the productivity of the management processes and social capital, an improved level of trust promotes economic growth (Lekovic, 2012: 70).

A low level of trust in society, on the other hand, may create a vicious cycle that may lead to poor economic growth. When trust level declines, politicians will rely on a populist line of approach, leading to imbalances, increase in tax rates and increase in administrative expenditures, thereby creating a vicious cycle of the negative business environment and low investment rates. In the end, this leads to a poor economic performance. On the other hand, poor trust level also directly affects the negative perception in business circles and poor investment and economic performance generate fiscal instabilities. As a result, the vicious cycle further takes root as the trust gets poorer (Györffy, 2008: 13). This process, which resulted in poor economic performance, is presented in Figure 2.

Figure 2: Low Level of Trust and Economic Growth



Source: Created by authors from Györffy, 2008: 13.

In sum, the economic activities that economic actors perform on the basis of trust result in success and low cost (Knack and Keefer, 1997: 1252). As seen in Figure 1, this triggers economic growth. The low trust level, on the other hand, undermines economic growth. However, it should be noted that trust involves the expectations and beliefs of one towards another and the expectations and beliefs towards the institutions. For this reason, trust should not be condoned to refer only to interpersonal relations. To this end, the notion of trust is divided into two categories, interpersonal and institutional trust (Lekovic, 2012: 70). Interpersonal trust refers to a forecast suggesting that others would not deliberately harm us (Delhey and Newton, 2005: 311). On the other hand, institutional trust points to individual trust in the institutions and their representatives. Additionally, trust is categorized as vertical and horizontal; horizontal trust refers to interpersonal trust, whereas vertical trust represents trust in the army, justice system, electoral system (Macchia and Plangnol, 2019) and such institutions as government, legislative organs, religious institutions and unions (Lekovic, 2012: 70). A society is composed of not only individuals but also of institutions as well. For this reason, for the safety and sustainability of the society, interpersonal (or horizontal/societal/general trust) (Miniesy and AbdelKarim, 2021: 1) as well as institutional (or vertical) trust matters.

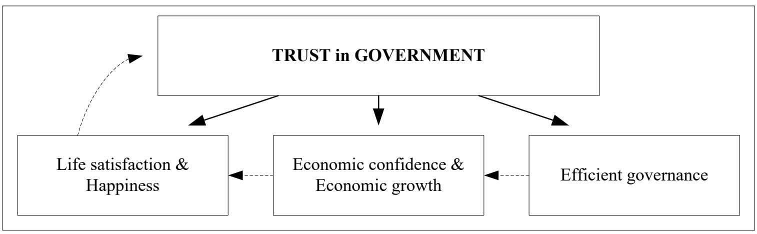
In regards to institutional trust, one of the most important concepts is trust in government. Trust in government reflects citizens' perceptions of the national government's problem-solving skills, its approach to social and economic problems, and its approach to justice. In other words, it expresses the attitude of citizens towards the action and performance of the national government (Keele, 2007: 242; Suriyanrattakorn and Chang, 2021: 2). According to another perspective, trust in government is a belief that the national government will perform its duties efficiently and will act in the public interest (Clark and Lee, 2001: 19). Just like interpersonal trust, trust in government has important economic and social effects on a country. For example, the financial crisis that broke out in 2008 caused trust in the government to drop considerably in many countries. This decline has put governments in a particularly difficult position with their ability to implement their current policies. Therefore, the decline in trust in government indicates that it will reduce the efficiency of the government. Therefore, trust in the government is an important factor that will increase the government's mobility and efficiency. More specifically, the expected positive effects of trust in government in the economic and social field may be summarized as follows (OECD, 2013: 20-23; Knack and Keefer, 1997:1253):

When trust in government increases;

- The fair and effective functioning potential of government agencies increases.
- The tendency of individuals who have long-term expectations from the government to give up their short-term interest increases. Therefore, government behavior can also be directed to the public interest.
- Implementation of structural reforms becomes easier.
- People become more willing to comply with the law.
- Economic confidence can increase by facilitating economic decisions.
- Statements of government officials become more convincing, which encourages investment and production.
- It increases the mobility of the government, especially in cases such as natural disasters and economic crises.

As might be seen, an increase in trust in the government basically increases the efficiency and mobility of the government. It also gives the government the potential to channel individual behavior toward the public good, improve economic prospects, make structural reforms more likely, and respond more quickly to social-economic crises. Increasing confidence in government statements also strengthens this potential. Thus, trust in government has the potential to affect economic growth and development, just like interpersonal trust. In addition, trust in government is also a factor that affects life satisfaction[1] and happiness since trust in government is closely related to government performance in many different aspects of life, such as increasing welfare, preventing social problems, and protecting the environment. Citizens living in a country can hold the government responsible for their quality of life (Bouckaert and Walle, 2001: 21; Liu et al., 2020: 975). Therefore, trust in the government not only ensures the effective functioning of government mechanisms but also affects the life satisfaction of citizens. As a result, increased trust in government is expected to activate the government's management processes, increase economic confidence, and positively affect life satisfaction, and thus happiness. It is also possible to argue that these effects trigger each other in a positive spiral form. Figure 3 illustrates all these effects of trust in government.

Figure 3: Social and Economic Effects of Trust in Government



Source: Created by authors from OECD, 2013: 20-23; Bouckaert and Walle, 2001: 21; Kalsoom et al., 2017 and Liu et al., 2020: 975.

3. Literature

The literature on trust can be divided into two parts: studies on social trust and institutional trust. Studies on social trust mostly focus on economic growth, whereas studies focusing on institutional trust mostly deal with trust in government. It is observable from the literature that the effect of trust in government on social variables such as life satisfaction or happiness, in general, is discussed.

Knack and Keefer (1997), investigate the relationship between social trust and growth using the panel ordinary least squares (OLS) method. In the study, in which 29 countries were analyzed, it was determined that social

1 Life satisfaction is the conscious judgment of one's own life. Happiness, on the other hand, is a collection of positive emotions such as life satisfaction, family satisfaction. Furthermore, the concepts of happiness and subjective well-being are used synonymously in the literature (Diener, 1994: 108; Kangal, 2013: 216). In this study, the concept of "happiness" is used.

trust had a positive effect on economic growth for the period of 1980-1992. Examining the same relationship for a larger country group, Berggren et al. (2007) look for answers to the question of what effect social trust has on economic growth for 63 countries. Least trimmed squares analysis was used in the study. Findings for the period of 1990-2000 reveal that social trust has a positive and significant effect on economic growth. Miniesy and AbdelKarim (2021), on the other hand, focus on the relationship between social trust and economic growth by using panel data analysis in their study for 104 countries including MENA countries. According to the panel pooled OLS (POLS) analysis, evidence was found that social trust affects economic growth in countries other than MENA countries. However, the countries where this effect is most evident are the transition economies in the sample. Cui (2017) investigates the relationship between social trust and economic growth for the 2001-2009 period in the panel data analysis he conducted with the data of Chinese provinces. According to the findings, there is a positive relationship between the trust variable and economic growth. However, as the institutional quality increases, the effect of this relationship decreases.

Zak and Knack (2001) analyze the relationship between trust and economic growth, applying two-stage least squares (2SLS) and OLS methods in their study using 1970-1992 period data. Analysis findings for 41 countries show that social trust increases economic growth. Kasmoui et al. (2018) examine the relationship between trust and economic growth using the sample of MENA countries. The researchers used 2SLS analysis in their analysis with the data of the 2010-2014 period. The findings reveal that as confidence increases; economic growth also increases. Bjornskov (2012) investigates the effect of trust on economic growth for 110 countries using 2SLS and 3SLS methods. According to the results of the analysis, trust affects economic growth positively and significantly. Dinçer and Uslaner (2010) examine the relationship between confidence level, economic growth, and employment by using time series data for the United States for the periods 1990-1994 and 1995-1999. The results show that an increase in the level of confidence increases the level of economic growth and employment in the manufacturing industry. Roth (2009) discusses the relationship between trust and economic growth in panel data analysis covering 41 countries. The study conducted for the period 1980-2004 determines that the level of trust has a negative relationship with economic growth and income. However, this relationship is positive for 6 transition economies with low confidence levels. Özcan and Bjornskov (2012) investigate the relationship between trust and the human development index, unlike the literature that generally focuses on the relationship between trust and economic growth. The study seeks to answer the question of whether social trust has an effect on human development by making use of the human development index and trust data for the 1980-2005 period. Data from 86 countries were used in the analysis. Using panel OLS analysis, the study determines that social trust had a positive and significant effect on the human development index. This effect is higher in countries with a low level of democracy.

Ananyev and Guriev (2019) seek an answer to the question of how the declining income due to the 2008 financial crisis affected social trust by using the survey data conducted in 66 regions for Russia in 2008 and 2009. The results of the OLS analysis show that the decrease in income also reduces social trust. Yamamura (2012), on the other hand, investigates the relationship between public sector size and social trust in the OLS analysis he conducted with the survey data obtained from 2790 participants aged between 20 and 89 in Japan. The study concludes that this relationship is insignificant in the non-working population and negative and significant in the working population. The study by Yamamura (2012), like Özcan and Bjornskov (2012) differs from the general trend in the literature in that it focuses on a variable different from economic growth and deals with the size of the public sector.

Hudson (2006), one of the studies focusing on trust in the government variable, investigates the relationship between trust in the government and the happiness of society in the panel data analysis he conducted on EU member countries for 15 years as of 2004, identifying a positive correlation between trust in government and happiness. In addition, the negative relationship between unemployment and trust in government is another finding of the study. Suriyanrattakorn and Chang (2021) discuss the relationship between trust and happiness in the government for the period 2011-2019 in the panel data analysis, which included 97 countries. The study reveals that trust in government positively affects happiness in both low-income and high-income countries. However, trust in government indirectly affects economic growth, albeit this effect is quite low. Kalsoom et al. (2017), in a multinomial logistic regression analysis conducted for 10 select Asian countries, suggest that trust in government positively affects happiness, using the data for the period 2010-2014. Macchia and Plagnol (2019), on the other hand, focus on the question of what are the effects of election security, trust in financial institutions, trust in government, trust in the army, trust in the justice system and trust in the police on life satisfaction in South American countries. All these variables, including trust in government, have a positive and significant effect on life satisfaction for the 2009-2016 period.

There are also studies in the literature that deals with the relationship between trust in government and different variables, apart from social variables such as happiness. For example, Munoz et al. (2011) investigate the effect of trust in government on trust in the European parliament in 22 European countries for the period 2004-2008. Accordingly, as trust in the government increases, trust in the European Parliament increases. On the other hand, the increase in the level of education has an effect that reduces the trust in the European Parliament. Gordon et al. (2019) examine the relationship between trust in government and public sector size, lobbying activities and efficiency in production for the United States. The study, using the data of the period 1960-2014, identifies a negative relationship between trust in the government, lobbying activities and the size of the public sector. The study further concludes that the relationship between trust in government and efficiency in production is positive in the long run. Finally, Roth et al. (2011) investigate the determinants of trust in the European Parliament and the European Commission in the dynamic OLS analysis he conducted for 27 European countries during the 1999-2010 period. According to the results, inflation and unemployment negatively affect trust in these two institutions in European countries, while economic growth positively affects trust in these two institutions.

As a general observation, it is possible to argue that the studies in the literature on trust often associate social trust with economic growth. These studies appear to have an agreement on the positive impact of social trust upon economic growth. Trust in the government is examined with reference to happiness in these studies. However, there are also studies that deal with trust in the government, focusing on different variables such as lobbying and efficiency in production. It is possible to argue that the literature on trust in government is in agreement that this variable increases happiness.

4. Empirical Analysis

4.1. Data Set

This study investigates the effect of trust in government on economic growth and happiness (subjective well-being) in EU-12 countries (Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, the Netherlands, Portugal, and the United Kingdom). Panel data analysis covers the years 2006-2020. Both static and dynamic panel data analysis methods are employed in the study. The variables used in the models and the source from which they have been compiled are presented in Table 1.

As a measure of growth, the study uses the Gross Domestic Product (GDP) variable per capita in US dollars at 2015 prices. The study relies on the data obtained from the World Bank in the model by taking its logarithm. The Trust in Government variable (TRUST) is expressed in the question "Do you have trust in the national government in this country?" referring to the number of people who answered yes to the question. The data, which were obtained by the survey method designed for the sample representing the population aged 15 and over, were compiled from the OECD database.

Happiness score (subjective well-being) has been obtained from World Happiness Report (WHR) data. In this data measurement, retrieved from the Gallup World Poll research, participants are asked to imagine a ladder numbered from 0 to 10, called the 'Cantril Ladder'. The top of the ladder represents the best possible life for the participant, and the bottom of the ladder represents the worst. The participants are asked the question "at which level do you feel you are in your life personally." This means that these data take values between 0 and 10, and higher values indicate higher life satisfaction.

In addition to the main variables, various control variables were utilized in the study. One is the governance (GOV) variable, which aims to measure the level of governance in countries. This index, obtained from the World Bank's Worldwide Governance Indicators (WGI) database, is based on the average of the six dimensions of Governance (Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption). The governance index ranges from -2.5 (poor governance performance) to 2.5 (strong governance performance).

Table 1: Variable Definition and Sources

Symbol	Definition of Variable	Data source
LGDP	GDP per capita (constant 2015 US$)	World Bank
TRUST	Trust in Government	OECD
HAPP	Happiness score	WHR
GOV	World Governance Indicators	World Bank, WGI
GEE	Government expenditure on education, total (% of government expenditure)	World Bank
GGFC	General government final consumption expenditure (constant 2015 US$)	World Bank
TRD	Trade (% of GDP)	World Bank
LEX	Life expectancy at birth, total (years)	World Bank

Government expenditure on education (GEE) is expressed as the percentage of public expenditures on education of total general government expenditures for all sectors. General government final consumption expenditure (GGFC) refers to all expenditures made by the government for the purchase of goods and services. These data are calculated using the 2015 fixed prices in US dollars. Trade (TRD) shows the share of exports and imports of goods and services in gross domestic product. Life expectancy at birth (LEX) indicates the number of years a newborn will live if the death rate at birth remains the same throughout his life.

4.2. Descriptive Statistics

The main descriptive statistics of the variables used in the analysis are shown in Table 2. In the EU-12 countries, the average GDP per capita for the period of 2006-2020 was 43,878.17 USD. The lowest value of the level of trust in the government in the sample countries is 12.6 (Greece), while the highest value is expressed as 82.4 (Luxembourg). The lowest and highest values in terms of happiness level were 4.72 (Greece) and 8.01 (Denmark), respectively.

Table 3 illustrates the correlation between the variables employed in the analyses. The findings reveal a positive correlation between LGDP and TRUST, and between HAPP, WGI and GEE variables, whereas they also show a negative correlation between LGDP and GGFC and LEX variables.

Table 2. Descriptive Statistics

Variables	Mean	Std. Dev.	Minimum	Maximum
GDP	43878.17	21503.63	17436.01	105454.7
TRUST	44.07713	16.300	12.6	82.4
HAPP	6.730519	0.706	4.720	8.018
GEE	11.07936	1.955553	7.18392	15.51264
GGFC	4.14e+11	7.10e+11	7.69e+09	2.80e+12
TRD	115.2627	88.69143	23.39447	408.362
LEX	80.86963	1.367005	77.6878	83.48537
WGI	1.211181	0.4353009	0.1477975	1.889047

Table 3. Correlation Matrix

Variables	LGDP	TRUST	HAPP	WGI	GEE	GGFC	TRD	LEX
LGDP	1000							
TRUST	0.727	1000						
HAPP	0.755	0.696	1000					
WGI	0.740	0.748	0.752	1000				
GEE	0.442	0.500	0.696	0.744	1000			
GGFC	-0.260	-0.194	0.045	-0.227	-0.216	1000		
TRD	0.782	0.562	0.359	0.536	0.179	-0.659	1000	
LEX	-0.082	-0.293	-0.271	-0.504	-0.535	0.172	0.050	1000

4.3. Method and Empirical Results

The study used both static and dynamic panel data analysis techniques to investigate the effect of trust in government on economic growth and happiness in EU-12 countries. If the sample used in the static panel data analysis covers the entire main population, the fixed effects model is preferred (Erlat, 1997: 11; Baltagi, 2001: 12). This is why this study preferred the fixed effects model. The generalized method of moments (GMM) estimator developed by Arellano-Bond (1991) was utilized to estimate the dynamic relationship between the variables. In dynamic panel models, the lagged values of the dependent variable are included in the model as the explanatory variable.

The study first examined the relationship between trust in government and economic growth in EU-12 countries. Model (1) and model (2), where the dependent variable is economic growth, are as follows:

$$LGDP_{it} = \alpha_0 + \beta_1 TrustInGovernment_{it} + \beta_2 X_{it} + \varepsilon_{it} \tag{1}$$

$$LGDP_{it} = \alpha LGDP_{it-1} + \beta_1 TrustInGovernment_{it} + \beta_2 X_{it} + v_i + \varepsilon_{it} \tag{2}$$

where α_0 is a constant term, v_i is the unobserved time-invariant specific effects and ε_{it} is the error term. $LGDP_{it}$ is the logarithmic form of per capita gross domestic product (GDP) and $LGDP_{it-1}$ is its lagged value. X_{it} is a vector of the following control variables: government expenditure on education, trade (% of GDP) and life expectancy at birth. Estimation results of Models 1 and 2 are reported in Table 4.

According to the fixed effects model results (Model 1) presented in Table 4, a positive and statistically significant relationship at the 1% level was found between trust in government (TRUST) and the dependent variable. In other words, an increase in the level of trust in the government in EU-12 countries positively affects economic growth. A positive relationship was also identified between the control variables, added to the model, Government Expenditure on education (GEE), trade (TRD) and life expectancy at birth (LEX) and economic growth (LGDP).

Table 4: Trust in Government and Economic Growth

	(Model 1)	(Model 2)
Variables	**LGDP**	**LGDP**
L.LGDP		0.692***
		(0.0766)
TRUST	0.0018***	0.0010*
	(0.0006)	(0.0005)
GEE	0.0119*	0.0047"
	(0.0070)	(0.0054)
TRD	0.0013*	0.0029***
	(0.0007)	(0.0004)
LEX	0.125***	0.0021
	(0.0032)	(0.0064)
Constant	-0.0505	
	(0.0402)	
Wald $\chi 2$		445.66
		[0.0000]
Sargan $\chi 2$		69.7890
		[0.1019]
AR(1)		-2.8157 [0.0049]
AR(2)		-.90101 [0.3676]
Observations	92	77
Number of id	11	11

Standard errors in parentheses. Values in square brackets are the probabilities.
**** $p<0.01$, ** $p<0.05$, * $p<0.1$*

Model 2 shows the dynamic panel data analysis results. In dynamic panel data analysis, firstly, Wald test, Sargan test and Arellano and Bond tests were applied to test the consistency of GMM estimators. The Wald test examines the significance of the model as a whole. According to the results of the Wald test in Model 2, it can be argued that the model is significant as a whole. Sargan test was applied to test the over-definition constraints of the instrument variables. The results confirm that appropriate instrument variables were used in the model as well. Finally, whether there is an autocorrelation problem in the models is tested using Arellano and Bond's autocorrelation test. Accordingly, the presence of first-order autocorrelation obtained as a result of the AR(1) test is considered normal due to the structure of the model. In addition, there is no autocorrelation problem in the AR(2) process, as expected. When we look at the results of the dynamic model, we see that there is a positive and statistically significant correlation of 1% between the dependent variable and its lagged value. As in Model 1, a positive relationship was identified between the level of trust in the government and economic growth. In addition, the effect of trade, one of the control variables, on economic growth was identified to be positive.

After examining the relationship between trust in government and economic growth, the study examines the relationship between trust in government and happiness in the sample countries. Models (3) and (4), where the dependent variable is happiness, are as follows:

$$Happiness_{it} = \alpha_i + \beta_1 TrustInGovernment_{it} + \beta_2 X_{it} + \varepsilon_{it} \tag{3}$$

$$Happiness_{it} = \alpha_0 Happiness_{it-1} + \beta_1 TrustInGovernment_{it} + \beta_2 X_{it} + v_i + \varepsilon_{it} \tag{4}$$

where α_0 is a constant term, v_i is the unobserved time-invariant specific effects and ε_{it} is the error term. $Happiness_{it}$ or subjective well-being refers to life satisfaction and $Happiness_{it-1}$ is its lagged value. X_{it}, the vector of control variables, consists of the following variables: Governance, LGDP and government final consumption expenditure. The analysis results for Models 3 and 4 are presented in Table 5.

Table 5: Trust in Government and Happiness

	(Model 3)	(Model 4)
Variables	**Happiness**	**Happiness**
L.HAPP		0.280***
		(0.0809)
TRUST	0.00975***	0.00838***
	(0.00202)	(0.00209)
GOV	0.769**	0.632**
	(0.303)	(0.283)
LGDP	0.470***	0.771**
	(0.0703)	(0.370)
GGFC	0.0312*	0.0276
	(0.0159)	(0.0219)
Constant	-0.247	0.280***
	(0.290)	(0.0809)
Wald χ2		
		0.0000
Sargan χ2		104.2851
		0.1134
AR(1)		-4.894
		0.0000
AR(2)		-1.1755
		0.2398
Observations	157	138
Number of id	12	12

Standard errors in parentheses. Values in square brackets are the probabilities.
**** p<0.01, ** p<0.05, * p<0.1*

According to the findings in Model 3, there is a positive and statistically significant correlation at the 1 percent level of significance between trust in government (TRUST) level and the dependent variable. In other words, an increase in trust in the government in the sample countries positively affects the level of happiness of individuals (HAPP). The study further identifies a positive relationship between governance (GOV), economic growth (LGDP) and government final consumption expenditure (CGFC), and level of happiness (HAPP).

Model 4 shows the dynamic panel data analysis results. When we look at the Wald test, Sargan test and Arellano and Bond test results that are used to test the consistency of the GMM estimators in the model, we see that the results are within the range of the expectations. According to the Wald test, the model is significant in its entirety. Sargan test results show that appropriate instrument variables are used in the model. While the result of AR(1) test shows the presence of first-order autocorrelation, there is no autocorrelation problem in the AR(2) process. According to the estimation results, there is a positive and statistically significant correlation of 1% between the dependent variable and its lagged value. There is a positive relationship between the level of trust in government and the level of happiness of individuals (subjective well-being). We have again obtained a positive relationship between the control variables of governance and economic growth and happiness.

5. Conclusion

It is generally accepted that incentive institutions play an important role in ensuring sustainable economic growth. The effects of the phenomenon of trust as an element of informal institutions have been investigated by social sciences such as economists, psychologists, sociologists, and philosophers in recent years. The fact that trust has the ability to direct economic activities without cost makes it even more important. Researchers reveal the process of trust influencing economic life in different aspects. In this context, the economic effects of different confidence classifications are analyzed. The results show that the establishment of trust among decision-makers has direct and indirect effects on the economy.

This study examines the effect of trust in government on economic growth and happiness. The analysis covers the data of EU-12 countries for the years 2006-2020. In modeling these relationships, the study employed both fixed attachments model and dynamic model within the scope of panel data analysis. The results of the analysis reveal that the increase in trust in government positively affects economic growth and happiness level. In short, the increase in trust in the government shows that the government increases economic confidence by activating management processes and positively affects happiness. On the other hand, the increase in trust in the government also increases the effectiveness of the policies to be implemented by policy-makers who have the ability to manage expectations. These results offer policymakers an opportunity to increase trust in government, economic growth and happiness at no cost.

The study preferred EU-12 countries for analytical purposes because of the accessibility of data for these countries. In the future studies, investigation of the economic impacts of trust in government in developing nations where institutional indicators such as property rights and the rule of law are relatively poor will contribute to the literature.

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7

Sustainable Development and Women Employment: The Case of OECD Countries

Nuran Öztürk Ofluoğlu (Trabzon University)
ORCID: 0000-0003-3617-5139
nozturk@trabzon.edu.tr

Abstract

One of the issues where gender inequality is most prevalent is employment. Since the industrial revolution, female employment has remained very low compared to male employment. Factors such as the number of dependent children, socio-cultural structure and education level prevent women from entering the labor market. However, female employment is more common in the informal labor market where wages and social rights are limited. All these bring along problems such as not being able to benefit from economic resources and women's poverty. Sustainable development also includes reducing gender gap. In this context, increasing women's employment will make significant contributions to the achievement of sustainable development goals. In the study, female employment in OECD countries is examined by graphical analysis method. It has been concluded that education is very important in increasing women's employment, and that the proportion of women should be increased especially in technical programs, management, and entrepreneurship.

Keywords: Sustainable Development, Women Employment, Inequality

JEL Codes: J21, D63, Q01

1. Introduction

Sustainable development defines "to be able to meet today's needs without compromising the ability to meet their own needs in future generations". According to this definition, sustainable development includes not only economic growth, but also the economic and human development of underdeveloped countries. Achieving sustainable development includes ending extreme poverty, tackling inequality and injustice, and ending climate change. Inequality or gender equality is important in areas such as education, health and employment. In terms of sustainable development, it is important to achieve equality in the employment of men and women and to employ more women.

According to the World Economic Forum (WEF)'s Global Gender Diversity Report (2020), one of the two areas where gender inequality is most prevalent is economic participation and economic opportunities. The other is the political power sub-index. Gender-based employment, which is an important indicator of economic participation and opportunities, is seen in all countries. For this reason, the issues of women's empowerment and gender equality are frequently discussed. However, the goal of eliminating inequality has not yet been achieved. With the Covid-19 global pandemic, this difference appears to be widening.

The inclusion of women in the work life and the employment of women for wages are important for the realization of sustainable development goals. Socially secure women are strengthened economically and poverty can be reduced. Therefore, the current state of women's employment and the Covid-19 effect should be demonstrated. In addition, determining the areas in which inequality is experienced in reaching economic opportunities will also shed light on the policies to be followed. For that reason, the current situation of women's employment and inequality has been examined with current data and more detailed. Based on this, the theories about women's employment are mentioned in the first part of the study and the current employment status is revealed with the graphs obtained from the data. In the second part, women's activities in technology, entrepreneurship and management in the fields of economic participation and opportunities are discussed with graphical analysis method and the relationship between poverty and women's employment is examined. In the study, OECD countries have been discussed since more reliable data can be obtained from a wide group of countries

2. Women's Labor Force Participation

From past to present, women employment has increased significantly. In this context, the First and Second World Wars and The Industrial Revolution are turning points in which the employment rate of women increased. I n particular, The Industrial Revolution caused women to take their place in the labor market due to cheap labor force. Thus, it has assigned new roles to women in the family and society (Kocacık & Gökkaya, 2005: 196). Thus, the concept of waged female labor force emerged for the first time in this period. In the 19th century, women constituted an important part of the total workforce in weaving manufacturing in many Western countries, especially in England (Hobsbawm, 2003: 63).

However, the fact that the jobs given to women are generally of a temporary nature and with low wages have caused the limited number of women in employment, the increase in the rate of transition to unemployment, the decrease in the quality of female labor force and the prevention of women's long-term employment. The traditional notion that women's work is to contribute to the livelihood of the family has led to women being seen as a reserve workforce, which is needed in the expansion period of the economy and easily abandoned during the recession.

Nonetheless, in developed countries where the level of education and per capita income is high, it is seen that women are better integrated into economic and social life. The implementation of policies in this direction for many years by these countries is the most important reason for high integration. The main indicator of women's participation in economic and social life is how much women participate in employment (TBMM, 2013: 5). Employed women become economically stronger and participate in social life.

2.1. Female Employment Theories

Women's employment, which has been the subject of more research since the 1970s, has also attracted the attention of feminist writers and labor market analysts, and many theories have been developed in this area. The Neoclassical labor model developed in this context examines the issue of women's employment based on their personal characteristics. The human capital theory is the most obvious example of this. This model explores the relationship between women's participation in the labor market, such as education, age and fertility, and their employment. In stratified labor market models, a number of features related to the structure of the female labor market are considered as the main factor in determining the quality of employment. Labor markets are divided into primary and secondary due to both the existing firm structures in the market and the characteristics created by the production organization. Generally, primary markets are considered to correspond to the formal sectors and include jobs that pay well and have social security benefits. Secondary markets include informal jobs. Jobs in the primary markets are held by men, while jobs in the secondary markets are usually held by women.

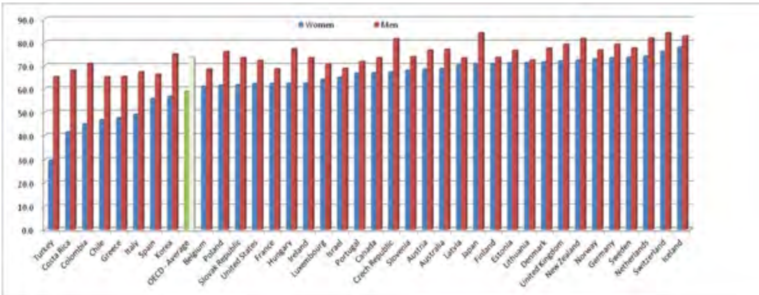
While the developments in women's employment are mainly examined with these approaches, feminist analysis contributes to the analysis of women's employment by stating that labor should be examined within social relations. In addition, it is emphasized that the changes that occur in the labor markets and their existing phenomena can only be understood based on these social values and relations. It would be an incomplete analysis to try to understand the functioning of the labor market by abstracting it from social values and relations (Dedeoğlu, 2000: 139). In other words, female labor force participation rates and their place in employment in a country are a complex combination of macroeconomic factors and socio-cultural structures that determine labor supply and demand. Socio-cultural factors, patriarchal structures, mentalities and practices that are dominant in the family, society and state may be effective in limiting women's labor supply by preventing women's education and employment.

The current stage of the patriarchal structure and capitalist development model, that is, the level of development of the countries, determines the female labor supply. For example, in the import substitution industrialization periods of capitalist economies, there was generally no need for female labor force. However, with the transition to the export-oriented industrialization strategy, cheap female labor force, which provides international competitive advantage, has gained importance (Toksöz, 2013: 2-3). The demand created by the labor market for women's labor, the physical demand conditions and the gender-based stratification in the labor market are the factors affecting the demand for women's labor. At the same time, women's labor is increasingly used in the growing informal sector as a result of this strategy (Dedeoğlu, 2000: 139). It is important to examine the factors that determine women's employment, which are examined on a theoretical basis, in order to examine the subject in more depth.

2.2. Female Employment and Determinants of Female Employment

Around the world, female labor force participation is approximately 49%, while this rate is 75% for males. The labor force participation gap of 26% is more than 50% in some regions (ILO, 2018: 7). Based on the level of development, it is seen that 60% of the female population of working age participate in the workforce in developed countries, and this rate decreases to 40% in less developed countries. In other words, gender inequality is more common in developing countries (Stevens, 2010: 3). A similar situation arises in OECD countries, and women's labor force participation generally increases in parallel with the level of development. The labor force participation rates of women and men in OECD countries are presented in Figure 1. As can be seen, women are less involved in the labor market than men in all countries. While the employment rate is 58.8% for women, it is 73.4% for men. Turkey has the lowest female employment rate with 29.7%; Iceland, on the other hand, is the OECD country with the highest female employment with 77.9%.

Figure 1: Percentage of Men and Women of Working Age in Employment (2020)



Source: It is created by the author, using data from OECD (2021a)

There are many factors that determine women's participation in the workforce. These; can be grouped under economic, social and demographic headings. Economic reasons are education and skill level, difficulty in obtaining retirement rights, social reasons, roles attributed to women such as maternity, child and elderly care and housework, gender discrimination and social pressure. In addition, the income level earned by the spouse can determine the participation of women in the labor market. If the income level of the spouse is low, the woman's working and reducing the family's financial difficulties come to the fore (Güneş, 2010: 37). Demographic reasons can be listed as marriage, having children and migration from village to city (Karadeniz & Yılmaz, 2007: 41).

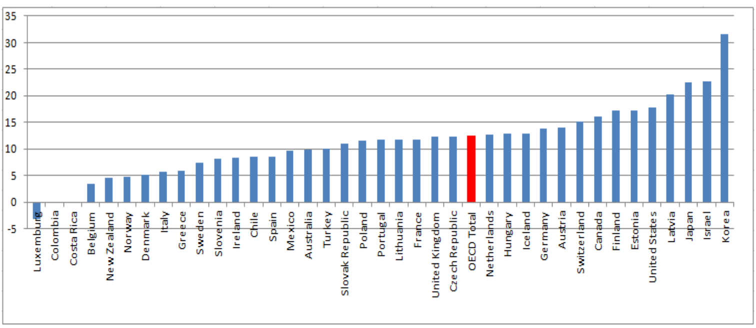
One of the most important factors determining women's participation in the labor force is whether they have children or not. In all socio-economic groups, women are more likely to have full-time jobs if they do not have children at home. However, compared to men, the majority of women work in part-time jobs (Kocacık & Gökkaya, 2005: 207).

Inequality of opportunity in education is another factor that leads to a low female employment rate. The difficulties encountered in obtaining a profession and getting education form the basis of inequality (Şahin & Bayhan, 2020: 65). Women are less educated than men and they have less professional experience due to child-rearing and family responsibilities (Erdut, 2005: 41). Traditional gender stereotypes and roles are important barriers to closing gender gaps. In countries with robust data, women seem to do more unpaid work than men. As a result, women have fewer opportunities to work for wages and develop their careers (Queisser, 2016: 88).

Women also face a number of problems after they join the workforce. Inequality in education and vocational training, employment and promotion, remuneration, benefiting from social rights and sexual harassment are some of these problems. These problems can result in job quitting or poor performance (Korkmaz, 2016: 304).

Discrimination in employment is also reflected in wages. Although women work the same amount of time and work as men, they earn less. Worldwide, the income earned by women is 18% less than that of men (Stevens, 2010: 3). In OECD countries, the wage gap between men and women working in full-time jobs is 12.5% on average (Figure 2). Developed countries such as Korea, Israel and Japan are the OECD countries with the highest wage gap. The countries with the lowest wage gap are Belgium, New Zealand and Norway, respectively. In addition, while there is no difference between male and female wages in Costa Rica, the wage gap is negative in Luxembourg and Colombia. Even in Northern European countries where female employment is high, such as Iceland, Switzerland, Nederlands and Sweden, the wage gap between men and women is quite large. The wage gap is 12.9% in Iceland, 15.1% in Switzerland, 12.7% in the Netherlands and 7.4% in Sweden.

Figure 2: Gender Wage Gaps (2020 or lastest years)



Source: It is created by the author, using data from OECD (2021b)

Note: Gender Gap in Median Earnings of Full Time Employees.

3. Women's Employment in Sustainable Development

Since the 1970s, problems related to poverty prevention policies, income dstribution injustice and people's quality of life have begun to take place within the scope of human-centered approaches to the development economics literature. In this perspective, which is called the "Basic Needs

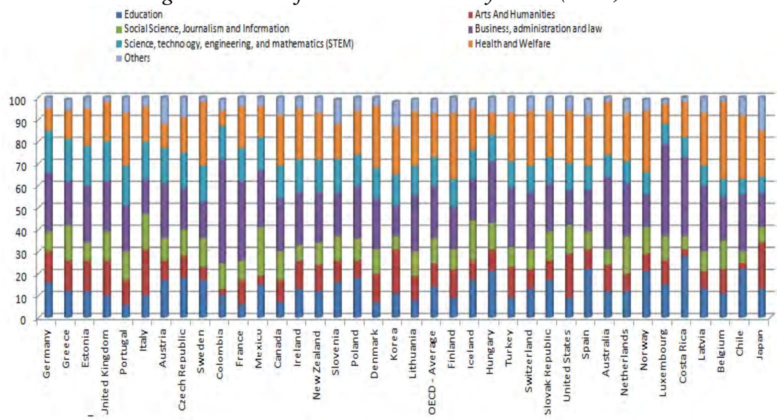
Approach", it is emphasized that the human being is at the center of development, and the development of human potential is the basic measure of development. According to this point of view, meeting certain physical, social and psychological needs, which are necessary and universal for people to lead a good life, forms the basis of development. The concepts of "sustainable development" and sustainable human development, which were developed in the 1990s, are addressed in this direction (Okumuş, 2010: 68-70).

Sustainable development includes economic and human developments as well as economic growth. The definition made by the United Nations World Commission on Environment and Development in 1987 clearly reveals this situation. According to this, "sustainable development is meeting the needs of the present without compromising the ability of future generations to meet their own needs." In other words, current development should be provided with an egalitarian approach that will meet the environmental and development needs of current and future generations (Al, 2019: 114-115). In line with this definition, seventeen objectives have been determined to achieve sustainable development until 2030. Seventeen goals are gathered within the framework of ending extreme poverty, combating inequality and injustice, and combating climate change. The realization of sustainable development without leaving anyone behind has an important place among these purposes. As one of the areas where gender equality is least achieved, women's employment is among the first issues to be addressed. In the continuation of the study, the relationship between women and technology, the positions of women in management and entrepreneurship, and the relationship between poverty reduction and women's employment are examined in order to increase women's employment and eliminate the employment gap between genders.

3.1. Women and Technology

According to the neo-classical growth model, technological development increases the efficiency of labor by providing a sustainable increase in productivity in the long run (Berber, 2006: 160). For this reason, the demand for the workforce to work in the field of science and technology is increasing day by day. In today's knowledge economy, it is important for women to work in this field for sustainable economic development (WEF, 2020: 38). However, when we look at the employment and education levels of women in the field of information and technology, it is seen that they are far behind men.

Figure 3: Share of Female Graduates by Fields (2019)



Note: "Other" includes: generic programs and qualifications; agriculture, forestry, fisheries and veterinary; services. Data on information and communication technologies are included in each field.

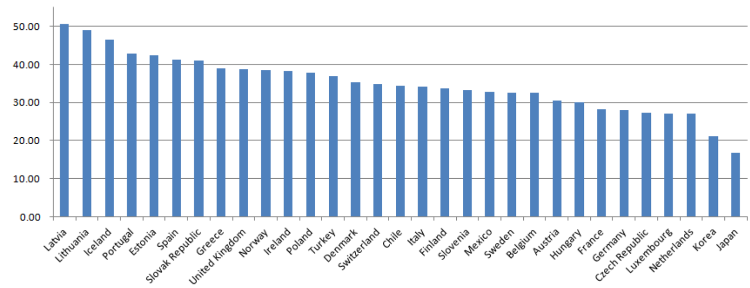
Source: It is created by the author, using data from OECD (2021c)

It is observed that the rate of women who have received education in science, technology, engineering and mathematics in OECD countries is at a very low level with an average of 13% (Figure 3). The countries with the highest this rate are Germany and Greece with 19%. In countries such as Japan, Chile, Luxembourg, the Netherlands, Turkey and the US, the proportion of women educated in science, technology, engineering and mathematics is below the OECD average. While this rate is only 7% in Japan and Chile, it is 12% in Turkey. From these figures, it is seen that the related fields are mostly preferred by men. The most preferred fields of women in higher education are business, management and law. Health and social assistance areas come second. It is understood that the distinction between women's work and men's work is still valid today.

According to UN The World Women Reports 2020, around the world, women are still not sufficiently represented with 35% among graduates of science, technology, engineering and mathematics departments. Women are also in the minority in scientific research and development, making up less than 30% of the world's researchers.

It is observed that the number of female researchers in OECD countries is generally lower than that of men, in parallel with the world data. In countries with the highest number of female researchers, Latvia is the country where the number of female researchers is higher than the number of male researchers (Figure 4). The countries with the lowest number of female researchers are Japan with 17%. Turkey, on the other hand, ranks 13th with 37%. Based on these data, it can be said that women should be more involved in science, technology and research in order to eliminate the distinction between men and women. In addition, increasing the number of female participants in computer science and engineering and technology-based professions will encourage innovation and economic development in all countries (OECD, 2008: 23).

Figure 4: Women Researcers as Share of Total (2019 or most recent year)



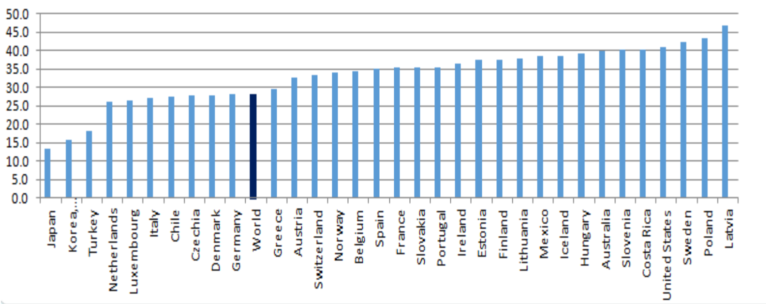
Source: It is created by the author, using data from OECD (2020a)

3.2. Women and Management

Women are not sufficiently represented at the management level. Despite an increase in their presence in the labor market, the number of women in management does not increase at the same rate. This situation constitutes another example of failure in benefiting from human capital (Stevens, 2010: 2). This situation, which is called the "Glass Ceiling", states that there are artificial and invisible barriers to the promotion of women and minorities to the administrative and management levels (Johns, 2013: 1). Women also face obstacles in the first step of transitioning to the management level (Broken Rungs). For this reason, they stay in the first step more than men. For every 100 men who are promoted to the first level of management, only 86 women can reach the first level. This means that much less women are involved in the later levels of management (McKinsey, 2021: 12, OECD, 2020: 5). However, according to the Catalyst (2007) report, women's involvement in senior management increases the performance and profitability of companies.

Figure 5 shows that the rate of women employed in senior management levels in the world is 28%. Japan, Korea, and Turkey are among the top three countries with the lowest ratio of women in management positions with 13%, 14% and 18%. Latvia (47%), Poland (43%) and Sweden (42%) are the countries with the highest rate.

Figure 5: Share of Employees in Managerial Position by Gender (2020 or lastest year avaliable)



Source: It is created by the author, using data from ILO (2020)

Even if the causality cannot be clearly demonstrated, the number of studies stating that the increase in the number of female managers has the potential to positively affect the performance and management of the company and that this may provide economic benefits is increasing day by day (OECD, 2020: 6).

Another indicator of how much women participate in the management is the rate of women in the boards of directors. Konrad et al. (2008) state that women exhibit a more collaborative management style in listening, social support and problem solving. They state that having more than three women in the board of directors will increase the performance of women.

According to the Catalyst (2021) report, the proportion of women represented on the board of directors decreased in 2020 compared to the previous year in France, Germany and Sweden (Table 1). In other countries, an increase is observed. Another striking point in the data is the low number of countries with no women on the board of directors. Accordingly, there are no women on some boards of directors in Austria, Germany, India, Japan and the US. The highest rate in this area is seen in Japan with 21.6%. Considering that women's participation in working life is also limited in this country, the result is not surprising.

Table 1: Women's Global Representations on Boards in Selected Countries

Country	% Women Directorship, 2020	% Women Directorship, 2019	% With three or more WOB, 2020	% With zero WOB, 2019
Australia	34	31.2	71.0	1.6
Canada	31.3	29.1	75.0	0.0
France	43.3	44.3	100	0.0
Germany	25.2	33.3	77.6	3.4
India	16.6	15.9	18.6	5.8
Japan	10.7	8.4	5.0	21.6
Netherlands	25.5	34.0	66.7	0.0
Sweden	38.0	39.6	91.2	0.0
Switzerland	26.1	24.9	54.8	0.0
United Kingdom	34.3	31.7	84.8	0.0
United States	28.2	26.1	66.0	0.2

Source: Catalyst (2021)

France draws attention in countries with more than three women on the board of directors. All of the company boards studied in France have more than three women. The country with the lowest number of more than three women on the board of directors is Japan.

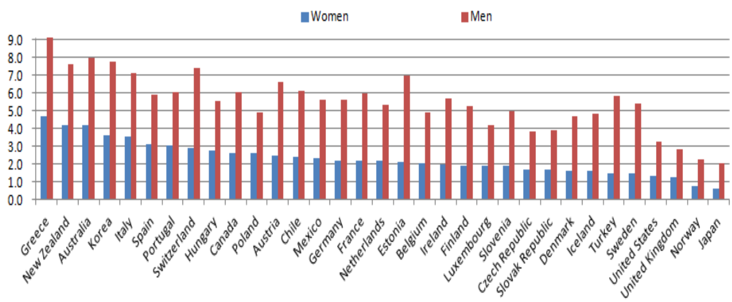
According to Lückerath-Rovers (2013), a homogeneous board of directors without women does not fully reflect the realities of the society in which it operates. Homogeneity is a sign of institutionally weak management. She also states that women will support the success of the company with a more creative, modern and transparent approach. Again, it is stated that the productivity of the employees will increase when they see that they can reach the upper levels. By promoting people according to their abilities rather than demographics, the company will benefit from not only half but all its talented employee pool (Lückerath-Rovers, 2013: 492-507).

3.3. Women and Entrepreneurship

Entrepreneurship accelerates economic growth by increasing employment opportunities, reducing poverty, promoting healthy national and international competition, as well as developing innovative and creative activities. Women's entrepreneurship, on the other hand, is seen as a potential way of empowering people and women living in developing rural areas and solving other social problems. Studies show that there is a positive relationship between women's entrepreneurship and sustainable development. Women's entrepreneurship can play an important role in promoting sustainable practices in the economy, social system and ecology to achieve sustainable development (Lordkipanidze et al., 2005: 790; Ambepitia, 2016: 162).

However, discussions about women's entrepreneurship still continue. Female entrepreneurs face more problems than their male counterparts (Mehtap et al.,2019: 47). Some of these problems are lack of trust among investors, discouraging social attitudes and gender discrimination, as well as the judgment of personal preferences in matters such as education, marriage, children and work-life balance (Byrne et al., 2019: 178-179). These difficulties are exacerbated in conservative and patriarchal societies, where women disproportionately assume household and family responsibilities and their actions are often limited by gender-related prejudices, stereotypes and socio-cultural norms (Mehtap et al., 2019: 45). Despite all these difficulties, the number of women's enterprises is increasing day by day. Women initiatives are an underutilized source of business and job creation (OECD, 2008: 35).

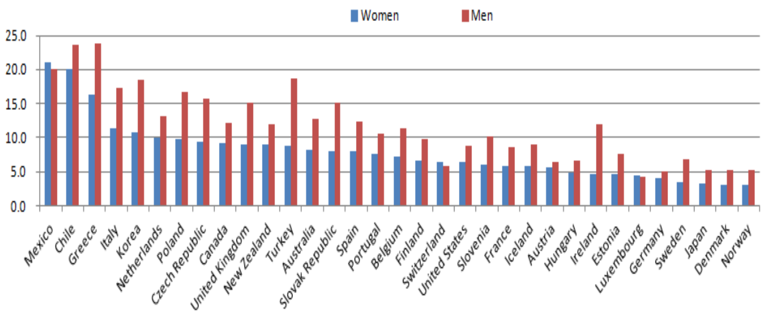
Figure 6: Share of Self-Employed Who are Employers (2019 or lastest year avaliable)



Source: It is created by the author, using data from OECD (2020d)

The ratio of female entrepreneurs to employers in OECD countries is relatively low compared to men (Figure 6). In Greece, the country with the highest rate of female entrepreneurs, the rate of male entrepreneurs (9.1%) is almost twice the rate of female entrepreneurs (4.7%). The countries with the lowest rate of employer women entrepreneurs are Japan (2%), Norway (2.3%) and the United Kingdom (2.8%), respectively. The rate of male entrepreneurs in these countries is 2%, 2.3% and 2.8%, respectively.

Figure 7: Share of Self Employed Who Are Own-Account Workers (2019 or lastest year avaliable)



Source: It is created by the author, using data from OECD (2021e)

When the rate of self-employed women entrepreneurs is analyzed, similar results are obtained, but higher rates than employer women entrepreneurs (Figure 7). From this, it is concluded that small-scale enterprises in which women work individually are more common in OECD countries. The country with the highest rate of self-employed women entrepreneurs is Mexico with 21%. In this country, the rate of female entrepreneurs working individually is higher than males (20.1%). In Chile, which ranks second, the rate of self-employed women entrepreneurs is 20.1%, while this rate for men is 23.5%. Norway has the lowest rate with 2.9% (male 5.3%). Norway is followed by Denmark (3.0% female, male 5.1%) and Japan (3.3% female, male 5.2).

According to the data obtained above, the number of women entrepreneurs is quite low in all OECD countries. In particular, it is observed that the majority of enterprises employing workers belong to men. From this, it is possible to say that women's entrepreneurship in OECD countries is activities carried out with individual efforts.

3.4. Women and Economic Growth

One of the most important factors determining macroeconomic performance in an economy is the amount of production factor employed. The higher the employment of the factors of production, the macroeconomic performance will be higher. For this reason, there is a very close relationship between female employment and sustainable growth (Akbakay, 2019: 300-301). Because the female workforce, which makes up half of the world's population, is among the least used economic resources

(OECD, 2008: 11). The use of these resources will make significant contributions to sustainable growth. For this reason, measures to increase women's employment are being implemented rapidly.

Women's participation in the workforce, and particularly their paid employment, has important consequences for themselves and for society:

It enables women to achieve economic independence and increases their power in domestic decision-making processes. One of the most important conditions for ensuring gender equality is the employability of women.

Women's employment is very important for sustainable economic growth and a balanced social development in all regions. A healthy and productive growth cannot be expected from an economy where women, who make up half of the total working age population, cannot participate effectively (Ecevit, 2010: 2).

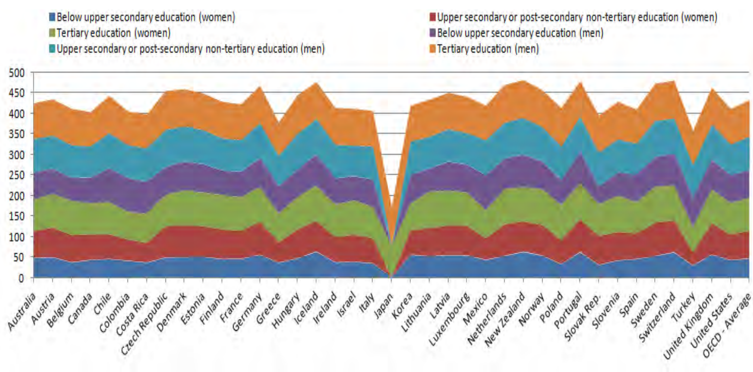
Education has a special importance in increasing women's employment. As education increases, employability increases and the positive externality created by education in economic development and growth positively affects the economy (Berber & Eser, 2008: 14). According to education economists, the productivity of the individual, whether male or female, increases in direct proportion to the level of education. A more educated workforce has an important role in adapting to new technologies, developing new technologies and increasing physical capital investments.

However, the economic efficiency of women's education is also high. In particular, its social efficiency is more important than that of the male population. By providing women with more education opportunities, poverty can be reduced in a country, productivity can be increased and the pressure of rapid population growth in economic and social development can be alleviated (Adem, 1993: 335-337).

In Figure 8, it is seen that the employment rate increases as the level of education increases in OECD countries. While the rate of female employment among higher education graduates in OECD countries is 80.6% on average, it is 88.7% for men. The employment rate of female tertiary education graduates is lower than that of men in all OECD countries.

Lithuania has the highest employment rate for female tertiary graduates (89.6%).The country with the lowest this rate is Turkey (62.2%). The employment rate of those with less than high school education is 46.7% for women on average, while it is 67.8% for men. With 28.9%, Turkey has the lowest employment rate for women with less than high school education (71.9% for men). Turkey is followed by Slovakia and Poland.

Figure 8: Female and Male Employment Rate by Education Level (2020 or lastest years avaliable)



Source: It is created by the author, using data from OECD (2020b) [1]

On the other hand, the correlation between the increase in the education level of women and the labor force participation rate is higher than men. However, the increase in the education level of women does not always reflect on the working conditions in a similar way to men (Beneria, 2001: 44-45). When we look at the education fields in Figure 8, this situation is clearly seen. Compared to men, women's employment rate increases more with the transition to higher education. For men, the employment areas of those who have completed high school or post-secondary education and those who have completed higher education are very close to each other. For women, on the other hand, at the same education levels, the employment area is wider at the higher education level.

3.5. Women and Poverty Reduction

Due to the inequality in accessing economic opportunities in both developed and developing countries, women make up 70% of the world's poor population (OECD, 2008: 11). Along with poverty, women cannot get enough of their social development and opportunities for development (Kocacık & Gökkaya, 2005: 96). While women and girls make up 50% of poor households in developing countries, this rate is 53% in European countries. Women living alone and older women face a higher risk of

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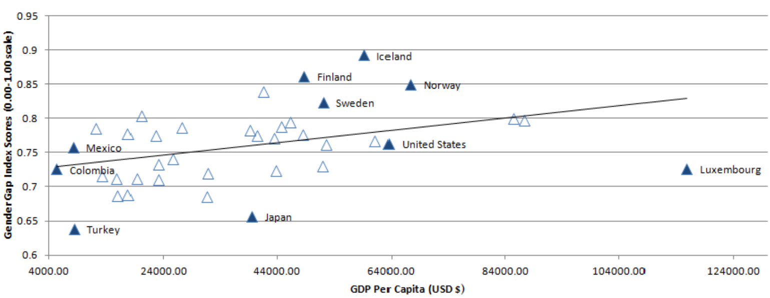
1 Data for Japan are only available for higher education. While the employment rate for men with higher education is 94.6% in Japan, this rate is 77.7% for women.

poverty than men (United Nations, https://unstats.un.org/unsd/gender/downloads/ Ch8_Poverty_info.pdf). The situation of women in underdeveloped and developing countries is defined as "feminization of poverty" (Peterson, 1987: 329).

On the other hand, the Covid-19 crisis has further widened the poverty gap between men and women. The United Nations estimates that between 2019 and 2021, the female poverty rate will increase by 9.1%, while it is expected to decrease by 2.7%. The data also shows that the pandemic will push 96 million people into extreme poverty by 2021, 47 million of whom are women and girls. This will increase the total number of women and girls living in extreme poverty to 435 million, with projections showing that this number will not revert to pre-pandemic levels until 2030 (United Nation Women, 2020: 1).

The Gender Gap Index shows a positive correlation between gender equality (as measured by economic participation, education, health, and women's representation in politics) and GDP (Gross Domectic Product) per Capita (Figure 9). In other words, GDP per capita increases with the development of women and the reduction of gender gap at the international level. However, this average result is not valid in all countries. High per capita income does not reduce gender inequality. For example, although the GDP is high in countries such as Japan and the USA, they are below the average in the Gender Gap Index.

Figure 9: Gender Gap and Per Capita GDP (2020)



Source: It is created by the author, using data from OECD (2020) and WEF (2020)

On the other hand, as economic equality between women and men is achieved, poverty decreases and gross national product increases. For example, micro-simulations for Turkey show that if the rate of women working full-time in paid jobs increases to 29%, poverty will decrease by 15% (Ecevit, 2010: 1). In this context, protecting and increasing the rights of working women, taking measures to prevent inequality between women and men in working life and taking necessary measures to strengthen women's non-governmental organizations contribute to reducing poverty by increasing women's employment (Aktan & Vural, 2002: 8). Women's employment means higher incomes entering the home and better living standards.

4. Conclusion

Economic growth is not enough to protect the living standards of future generations. People's well being depend on meeting some of their physical and psychological needs. In this respect, the concept of sustainable development, including human development, covers topics such as preventing climate change, injustice, inequality and fighting poverty. Under the heading of inequality, it is emphasized that the disadvantaged situations of women should be eliminated. The female employment rate is quite low and mostly the jobs in the secondary market are done by women. Employment of women, who make up half of the world's population, will provide significant benefits for both society and themselves.

From the data obtained in the study, it is understood that the employment rate of women in OECD countries is lower than in men. In addition, the male-female wage gap is still very high even in developed countries such as Korea, the US and Japan. Another factor that determines women's employment is their fields of study. The rate of women choosing technical programs is quite low. From here, it can be said that the distinction between women's work and men's work is still applied. In parallel, the number of female researchers in countries such as Japan, Korea and Turkey, where women's employment follows as a similar trend. Again, the proportion of women in senior management in these countries has a similar characteristic. Data from the OECD show that female entrepreneurship is not sufficient and is very low compared to men. This difference between men and women is more pronounced in entrepreneurs who are employers. From here, it is possible to say that women's entrepreneurship is carried out in the form of small businesses on an individual basis .

One of the objectives of sustainable development is to reduce poverty. Around the world, the female poverty rate is 70% and is expressed as feminization of poverty. The data shows that GDP increases as the gender gap decreases. Accordingly, policies that reduce the gender gap will increase the level of welfare.

There are a wide range of barriers to increasing women's employment and eliminating gender differences. The role assumed due to the patriarchal structure causes women to stay away from business life or to be unsuccessful in their profession. In this context, externalizing child and elderly care and household responsibilities will increase women's employment. However, it is thought that men should be allowed to take care of children to the extent that the social structure allows. Thus, by sharing responsibilities together, parents can prevent the woman from falling behind in business life. In addition, maternity leave for women leads to dismissals or the absence of employment. Giving children and elderly care leave to men will eliminate this disadvantage.

One of the factors that determines the female employment rate is education. With the transition to higher education, the female employment rate increases more than men. Therefore, it is important to encourage women to higher education. In addition, not only women's education, but also men's education is important in order to change the social structure. It is thought that this education should be supported by using media and other communication channels. In addition, the introduction of incentives or scholarships that will enable women to receive education and career in their technical fields will reduce the gap in this field.

Flexible working hours is another policy that can be implemented. However, the mitigating effect of the flexible working system, which has examples among the countries of the world and is applied in many countries such as Germany and the Netherlands, on unemployment is controversial (Hekimler, 2008: 15). Therefore, the flexible working system should be reviewed.

It is observed that quotas are generally applied in order to ensure that women take part in senior management. The dissemination of similar practices, starting with public institutions, will help increase the number of female managers.

Entrepreneurship is one of the proposed policies in increasing women's employment. However, it is understood from the data that this policy cannot be implemented effectively. Women's enterpreneurship often remain individual efforts on a very small scale. Therefore, it is thought that women's entrepreneurship should be re-evaluated.

Reducing women's poverty can be achieved by increasing the employment rate. However, this does not apply to the female population who are not in the workforce. The sustained aid policies of the state or non-governmental organizations will be able to eliminate the disadvantage of this segment.

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8

Analysis of the Relationships Among R&D Nanotechnology Patents and Economic Development

Pınar Koç (Gumushane University)
ORCID: 0000-0002-7843-1228
pinartorun@gumushane.edu.tr

Abstract

While equipment based on nanotechnology positively affects the production process by increasing efficiency and productivity, they play an important role in achieving sustainable development targets by rising renewable energy production and energy saving. However, in the literature there are no studies that analyze the effect of nanotechnology applications on economic growth. In this context, The aim of this study is to investigate relationships among R&D expenditures, nanotechnology, and economic development in the short run in G7 countries for the period of 1990-2017. The number of Nanotechnology patents was used as a proxy for Nanotechnology applications. GDP per capita and R&D expenditures are other indicators included in the model. Dumitrescu & Hurlin panel causality test was used to analyze relationships between the variables in the short term. The results indicate that there is unidirectional causality from GDP Per Capita to R&D Expenditures and Nanotechnology applications. In addition, GDP Per Capita Granger causes nanotechnology applications. In this context, it can be concluded that GDP Per Capita is the leading indicator for Nanotechnology applications and R&D Expenditures.

Keywords: Economic Development, Nanotechnology Patents, R&D, Dumitrescu&Hurlin Causality

JEL Codes: O11, O32, O33

1. Introduction

Solow (1956) growth model, which dominates the economic growth model until the late 1950s to 1980s, emphasized that economic growth can be explained by technological development, but didn't explain how technological development took place. In this context, technological development is an exogenous factor in the Solow growth model. Until 1980 years, devaluation, high profitability, low wage and costs were considered as key determinants of international competitiveness.

However, increasing globalization trends and product diversity showed that in addition to monetary factors, factors such as price and product differentiation, access to new markets, level of technological development, social and cultural values play an important role in international competitiveness. (Lundvall, 2005; Castells, 2008). Therefore, the attempts at technological development started to increase and Romer (1990) did a preliminary study emphasizing the importance of R & D expenditures on economic growth. In Romer Model, a company operating in the monopolistic competition market develops new ideas and products by bearing R&D costs and it goes the way of monopolization via patent and property rights. Monopolistic power obtained via patent and property rights offer the possibility of abnormal profit. The increase in knowledge production encourages macroeconomic growth whereas the increase in profit opportunity encourages growth for the company. The presence of industries that can produce with high tech intensive products rises the demand for goods and services with high-tech density by increasing new research areas and they also encourage quality human capital demand. Therefore, the increase in production of high value added goods and services has a positive impact on the economic development process. Nanotechnology is expected to increase sustainability by providing both a cost, efficiency advantage and contributing to energy savings. In this context, nanotechnology is particularly important for sustainable development targets.

Byun et al. (2013), Lozano et al. (2016), Grigoryeva et al. (2017) emphasized that nanotechnology increases the effectiveness of lighting Systems by providing energy saving. Also, Roco (2001), Chen & Mao (2007), Rickerby & Morrison (2007), Fleischer & Grunwald (2008), Serrano et al., (2009), Christian et al. (2013), Abdin et al. (2013), Diallo et al. (2013), Hussein (2015), Echiegu (2016), Ahmadi et al. (2018) emphasized that nanomaterials such as photovoltaics, solar cells, fuel cells, nano-batteries increase the efficiency of renewable energy production, storage, and usage. Dutta et al. (2006), Zhang et al. (2011), Abdin et al. (2013), Singh (2017), Denkena et al. (2020) expressed that nanotechnology rises the strengths of machines while it reduces production costs.

In this study, the short-run relationships among R&D expenditures, nanotechnology and national income were analyzed by considering the effect of the increase in R&D on technological and economic development and the advantages of nanotechnology. Although there are many studies in the literature that empirically analyze the relationship between R&D expenditures and economic development there is no study that empirically analyzes the role of the increases in R&D expenditures in nanotechnology development and the contribution of these developments in the economic growth process. In this context, the study is expected to contribute to the literature.

2. Empirical Literature

There are many studies that examine the relationships between R&D expenditures and economic growth based on endogenous growth theory. In this section, recent studies were included. Falk (2007) analyzed the effect of the R&D investments on economic growth by using dynamic panel data in OECD countries for the period of 1970-2004. According to the results of the study, there is a strong positive relationship between R&D investments in the high-tech sector and economic growth in the long-term.

Horvath (2011) examined the relationships between R&D expenditures and economic growth based on Bayesian Approach. The findings confirm the positive effect of R&D expenditures on economic growth.

Anousheh (2012) analyzed examined the relationship between R&D expenditures and economic growth in OIC countries. R&D expenditures of government, high education institutions positively affect economic growth.

Wang et al. (2013) investigated the effect of high tech industrial R&D expenditures on economic growth by using quantile regression. The results show that high-tech industrial R&D spending has a strong positive effect on GDP per capita at the highest quantile of the distribution. However, all sectors' R&D spending relative to GDP is subject to significant negative returns only when considering the middle income countries.

Pop Silahgi et al. (2014) analyzed the effects of R&D expenditures of the private and public sectors on economic growth in Central and Eastern Europe. According to the results of the study, while R&D expenditures of the private sector have a positive effect on economic growth, R&D expenditures of the public sector don't play an important role in economic growth.

Inekwe (2015) examined the role of R&D expenditures on economic growth in developing countries via the GMM model. R&D expenditures have a positive impact on economic growth in upper middle income countries while there is no statistically significant relationship between R&D expenditures and economic growth.

Kaur & Singh (2016) confirmed that R&D expenditures play an important role in economic growth in 23 countries. The study has been interpreted as the increase in the variability of the coefficient representing economic and technological activities, and there is no possibility of convergence in the countries involved in the analysis.

Hafeez et al. (2019) investigated whether R&D expenditures of the Government affect economic growth by using the PMG approach. The results show that R&D expenditures have a positive impact on economic growth in the long term.

Das (2020) analyzed the multidirectional relationship among R&D expenditures, patents, and economic growth. There is unidirectional causality from economic growth and the number of patents to R&D expenditures in the short term. However, there is no statistically significant relationship between the number of patents and economic growth in the long term.

There are many studies that empirically analyze the relationships between R&D expenditures and economic growth. Genç & Atasoy (2010) investigated causal relationships between R&D expenditures and economic growth in 34 countries. According to the findings of the study, R&D expenditures Granger cause economic growth.

Gülmez &Yardımcıoğlu (2012) analyzed the effects of R&D expenditures on economic growth by using panel cointegration tests in 21 OECD countries for the period of 1990-2010. The results that the income elasticity of R&D expenditures is 0.77.

Özcan & Arı (2014) examined the relationship between R&D expenditures and economic growth in 15 OECD countries for the period of 1990-2011. R&D expenditures have a positive impact on economic growth.

Altıntaş & Mercan (2015) investigated long run relationships between R&D expenditures and economic growth by including R&D expenditures to Cobb-Douglas production Function in 21 OECD countries for the period of 1996-2011. Acc ording to the findings of the study labor, capital and R&D expenditures positively affect economic growth.

Kutbay & Öz (2017) analyzed the relationships between R&D expenditures, tax incentives and national income in 9 OECD countries for the period of 1999-2016. The results confirm the hypothesis that R&D expenditures encourage economic growth.

Güneş (2019) examined the causal relationships between R&D expenditures and economic growth in 32 OECD countries for the period of 2000-2014. According to the results of the study, there is unidirectional causality from R&D expenditures to economic growth.

Cinel & Yamak (2021) investigated the effect of R&D expenditures on economic growth in the base of both types of expenditures and sectoral expenditures amounts in Turkey. The biggest contributor to economic growth is higher education R&D expenditures while the type of expenditure the least contributing to economic growth private sector R&D. Unlike other studies, this study the relationships among R&D expenditures, nanotechnology patents and economic growth were analyzed.

3. Data and Methodology

3.1. Data

The aim of this study, covering the period of 1990-2017, is to investigate the relationships among R&D expenditures nanotechnology patents and GDP per capita. The variables used in the study are given in Table 1. Dataset is annual and was obtained from the OECD database.

Table 1: Variables and Dataset

Variables	Notation	Database
GDP Per Capita	GDP	OECD
Nanotechnology Patents	NANO	
R&D Expenditures	R&D	

3.2. Methodology

Dumitrescu & Hurlin (2012) Panel Causality Test was used in order to the relationships among R&D, nanotechnology patents and GDP per capita.

3.2.1. Dumitrescu & Hurlin Panel Causality Test

Dumitrescu & Hurlin panel causality test takes into account the existence of heterogeneity between cross-sections in panel data set. X and Y denote two stationary variables observed for N individuals on T periods and the causality from X to Y formulates as follows;

$$Y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} X_{i,t-k}$$

α_i representing individual effect is fixed in the time dimension. But, β_i representing slope parameters varies from unit to unit. Therefore, the causality test is based on fixed effect model. The null hypothesis denotes that there is no homogen Granger causality while alternative hypothesis indicates that there is causality between two variables in at least one unit.

4. Estimation Results

Descriptive statistics are given in Table 2. According to Table 2, Japan and USA have the highest number of the nanotechnology patents. The USA has the most average GDP per capita compared to other G7 countries. Similarly, The USA has the highest R&D expenditures. Italy and Canada have the lowest nanotechnology patent and R&D expenditure. At the same time, Italy has the lowest GDP per capita.

Table 2: Descriptive Statistics

Countries	NANO		GDP		R&D	
	μ	σ	μ	σ	μ	σ
France	59.79	36.73	37434	3408	51184	6700
Germany	102.52	73.24	41571	4472	85495	18748
England	44.49	22.87	37580	4800	37231	5754
USA	392.89	217.02	49194	6122	378217	89533
Japan	520.07	309.56	37556	2352	143510	19939
Italy	13.07	10.01	37829	2327	24919	3846
Canada	22.71	16.04	38790	4726	22355	5193

μ, σ represents mean and standard deviation, respectively

Table 3 illustrates the correlation the relationships among R&D expenditures, nanotechnology patents and GDP per capita. According to Table 3, while there is a positive moderate correlation between R&D expenditures, nanotechnology patents and GDP per capita, there is a positive high correlation between GDP per capita and R&D expenditures.

Table 3: Correlations among R&D Expenditures, GDP per capita and Nanotechnology patents

Variables	NANO	GDP	ARGE
NANO	1.000	-	-
GDP	0.33 (0.000) *	1.000	-
ARGE	0.61 (0.000) *	0.73 (0.000) *	1.000

**represents 1 % significance level*

Dumitrescu & Hurlin Panel Causality Test was developed for situations where X and Y variables are stationary. Therefore, firstly, in this study the stationary of the variables was tested. In addition, the presence of cross-sectional dependence in the panel data set result in the loss of reliability of estimated statistics. For this reason, the presence of cross-sectional dependence in panel data was tested. Because the number of unit dimensions (N) is less than the number of time dimensions, Breusch & Pagan (1980) test was used in the study. Table 4 illustrates the results of the Breusch & Pagan test. The results show that the panel data set contains cross-sectional dependency problem.

Table 4: The Results of Cross-Sectional Dependency

Test Türü	**GDP**		**NANO**		**R&D**	
	Test Stat	**P**	**Test Stat**	**P**	**Test Stat**	**P**
Breusch-Pagan LM Test	469.99	0.000*	431.69	0.000*	517.92	0.000*

**represents 1 % significance level*

Pesaran CIPS unit root test taking into account cross-sectional dependency was applied to test the stationary of the variables. Table 5 illustrates the results of The Pesaran Unit Root Test. The results of the estimation show that GDP per capita and the number of nanotechnology patents are not stationary at the level. Therefore, the first differences of these series were obtained and stationary test was applied to the first difference series. While R&D expenditure is stationary at the level, GDP per capita and the number of nanotechnology patents are stationary at the first differences.

Table 5: The Results of Pesaran Unit Root Test

Test	GDP (Level)		NANO (Level)		R&D(Level)	
	Test Stat	P	Test Stat	P	Test Stat	P
Pesaran	-1.875	0.377	-2.097	0.179	-2.356	0.052***
	GDP (Difference)		NANO (Difference)		R&D(Difference)	
	Test Stat	P	Test Stat	P	Test Stat	P
	-3.182	0.000	-3.936	0.000	-	-

***** *represents 10 % significance level*

Causality relationships among R&D expenditures, GDP per capita and the number of nanotechnology patents were investigated by using stationary series. The results are given in Table 6. According to Table 6, there is unidirectional causality from GDP per capita to R&D expenditures at the levels first and third lag while there is unidirectional causality from R&D expenditures to the number of nanotechnology patents at the level all lags. In addition, GDP per capita Granger causes the number of nanotechnology patents at the levels first and second lag.

Table 6: Dumitrescu & Hurlin Panel Causality Test

Direction of Causality	k=1		k=2		k=3	
	Test Stat	P	Test Stat	P	Test Stat	P
GDP→ARGE	5.95	0.0000*	1.46	0.1437	2 .16	0.0307**
ARGE → GDP	0.34	0.7328	0.68	0.4911	0.89	0.3711
NANO →ARGE	0.43	0.6616	1.44	0.1482	-0.09	0.9244
ARGE → NANO	2.11	0.0343**	2.48	0.0129**	2.52	0.0116**
GDP→ NANO	2.17	0.0298**	1.76	0.0781***	1.39	0.1628
$NANO$ → GDP	0.30	0.7629	-0.94	0.3446	-0.48	0.6254

*, **, *** *represents 1 %, 5 %, 10 % significance level, respectively.*

5. Conclusion

The presence of industries that can produce high-tech intensive products rises the demand for goods and services with high-tech density by increasing new research areas and they also encourage quality human capital demand. Therefore, the increase in production of high value-added goods and services has a positive impact on the economic development process. Nanotechnology is expected to increase sustainability by providing both a cost, efficiency advantage and contributing to energy savings. In this context, nanotechnology is particularly important for sustainable development targets. In available literature, there are many studies that analyze the relationships between R&D expenditures and economic growth by using Romer Model. But, the relationship between the number of nanotechnology patent R&D expenditures and economic growth were not investigated. In this context, in this study, covering the period of 1990-2017, the causality relationships among R&D expenditures, the number of nanotechnology patents and GDP per capita were analyzed. The results show that Japan and USA countries where to have the highest nanotechnology patents. The USA has the highest average GDP per capita and R&D expenditures while Italy has the lowest GDP per capita. Italy and Canada countries where have the lowest nanotechnology patents and R&D expenditure. While there is a positive moderate correlation between R&D expenditures, nanotechnology patents and GDP per capita, there is a positive high correlation between GDP per capita and R&D expenditures. According to the results of the causality test, national income and R&D expenditures are leading indicators for the number of nanotechnology patent. High income countries put more financial resources into technology investments compared to low income countries and they use more nanotechnological products depending on their level of technological development.

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PART III

INTERNATIONAL TRADE AND FINANCE

9

The Role of Central Banks in Sustainable Development

Ömer Faruk Kömürcüoğlu (Karadeniz Technical University)
ORCID: 0000-0002-8399-5597
ofkomurcuoglu@outlook.com

Abstract

It is a known fact that environmental risks have increased significantly. As a result, climate change inevitably affects economies as well. In order to minimize these effects, sustainable development is considered an important goal for economic policy. It is critically important for the social benefit that central banks, which are among the actors of the policy-making process, act in harmony with this goal. In addition, the regulatory and information-gaining authority of central banks gives rise to dominance over money, credit, and the financial system. It is possible to use these powers in a way that reduces environmental risks and supports sustainable development. The aim of the study is to examine the roles that central banks can play in the sustainable development process. For this reason, it is discussed why the concept of sustainable development is important for central banks, and also the policy tools that can be used to prioritize green finance are evaluated.

Keywords: Sustainable Development, Central Banking, Green Finance

JEL Codes: Q01, E58, Q5

1. Introduction

Central banks have been institutions that are responsible for the monetary system as a whole and have vital importance for the economies, especially the printing of money and the implementation of monetary policies. As a matter of fact, the number of central banks, which was 18 a little over a century ago, has increased rapidly, approaching 200 today. On the other hand, the institutional structuring of central banks and the economic policies they implement cannot inevitably be considered independent of the economic priorities and political and social structure of the geography they are in. In this context, since the establishment of the Swedish Central Bank (Riskbank), which was established in the 21st century and is the first example of central banking, there has been a change in the institutional structure, objectives and duties, and authorities of central banks; differentiated to adapt to its external and internal dynamics.

The developments in financial markets, which accelerated its technological developments after the 1980s, and the integration between capital markets created another difficult bend for central banks. The weakening of the relationship between targeted monetary aggregates and inflation made it difficult to determine the monetary aggregates determining inflation and severed the link between the two. In this context, targeting monetary aggregates could not respond to changing conditions, and the inflation targeting strategy became a popular monetary policy.

With the widespread implementation of inflation targeting all over the world, the principles of central bank independence, transparency, and accountability have become increasingly important. While the inflation targeting strategy predicts that financial stability will be achieved with price stability, the 2008 Global Financial Crisis that broke out in an environment where prices were at a very reasonable level and inflation was restrained all over the world caused the eyes to be turned to central banks again. Criticisms began to be voiced in a high tone at the point that the inflation targeting strategy attaches too much importance to price stability and therefore misses financial stability, and that it considers economic growth and employment targets as secondary objectives. Adding to this the increasing environmental awareness on a global scale, sustainability and environmental pollution issues have started to come to the fore for central banks.

On the other hand, the globalization movement, which gained momentum in the post-World War II period, increased industrial production. Almost every country followed similar growth policies and mass production gained momentum. However, such a process inevitably brought humanity and nature face to face. The increase in the average temperature of the world, the depletion of the ozone layer, deforestation, water, soil, and air pollution, excessive urbanization, uncontrolled agriculture, etc. many other negative factors such as nature's response to human greed.

This unsustainable struggle of humankind and nature has brought up the necessity of creating policies in peace with the environment in every field. Therefore, it is important for economic activities to be more environmentally friendly, in other words, to be sustainable.

It is undeniable that central banking plays a vital role in the economy. Executing this role with more environmentally friendly and sustainable elements can also increase social welfare. Although the effects of central banks on sustainable development is a proposal that conflicts with the mainstream economics teachings, it is an important issue in terms of providing polyphony in the economic literature. Within the scope of this view, central banks should diversify their policy tools and guide the banking sector according to sustainable development.

In the light of the above evaluations, the concept of sustainable development will be discussed in general in the first part. In this section, the development of the concept in the historical process and the international steps taken for sustainable development will be focused on. In the following part of the study, the transformations that central banking has experienced in the process leading to its relationship with sustainable development will be expressed. Then, it will be evaluated what kind of activities central banks can carry out and which tools they can benefit from for sustainable development.

2. Sustainable Development: Overview

The concept of sustainable development, which entered our lives towards the end of the 20th century, means meeting the needs of the present without reducing the opportunities of future generations to meet their needs. The report of the World Commission on Development and Environment (WCED), called "Our Common Future (WCED, 1978)", which would later be known as the Brundtland Report, revealed the importance of this concept for the first time. The report expresses the environmental problems that threaten our world in general and what needs to be done at the international level to solve these problems. In the words of Gro Harlem Brundtland, the purpose of writing the report can be expressed as follows (WCED, 1978: 11):

- Establishing a long-term environmental strategy to achieve sustainable development goals as we enter the millennium;

- Emphasizing greater cooperation between developing countries and countries at different stages of economic development; thus suggesting ways for countries to achieve sustainable development goals on a common ground that takes into account people, resources, environment, and development relations;

- Suggesting various ways and methods to stakeholders to deal with environmental problems more effectively;

- To help define desired targets to create a common perception about environmental problems and to put forth the necessary effort to solve these problems for decades.

The report addressed the need for a comprehensive attitude change in society for sustainable development. Again, the report emphasized that the economy and social welfare are always dependent on the environment, regardless of the level of development of the countries.

Giddings et al. (2002: 189-192) divided the concept of sustainable development into weak and strong sustainable development. Weak sustainable development; evaluates sustainable development as the common point/intersection cluster of the fields of society, environment, and economy. Strong sustainable development is; It expresses sustainable development in the form of intertwined and covering concepts in the form of economy, society, and environment, respectively. From this point of view, weak sustainable development may lead policymakers to the mistake of looking at one area (eg economy) and ignoring other areas (society and environment). However, strong sustainable development tends to see the economy in the society and the society in the environment in which it lives. Therefore, in this perspective, nature is in a priority position.

It can be said that the concept of *"sustainability"* has become important with the increase in economic, environmental, and social problems. Therefore, in terms of development, countries should harmonize their economic growth activities with the environment and society and make them sustainable. In this context, development has a much broader definition than growth. While growth is roughly defined as an increase in production; development also refers to cultural, social, environmental, humanitarian, and many more aspects. From this point of view, the concepts of sustainable and inclusive growth, in general, play an important role in sustainable development goals. Inclusive growth can be defined as growth in which people both contribute and benefit to eradicate poverty in a powerful and lasting way (International Monetary Fund [IMF], 2012: 147-148).

The Limits to Growth report, published in 1972, and the ensuing 1973 Oil Crisis showed that the policy of “growth at all costs” also has a limit. Discussions made within this framework have revealed the fact that the development followed based on industrial growth will not create a continuous increase in welfare. In this sense, the “limits of growth” made it possible to discuss a development approach that prioritizes the environment by raising awareness of the society (Öztürk, 2016: 33). It has been discussed in the literature that growth processes based on industrial growth and welfare increase are not spread to the base and non-inclusive growth processes are not sustainable. According to Carruthers (2001: 95-96), these discussions in the literature contributed significantly to the establishment of the understanding of sustainable development. These contributions can be listed in four items:

1. The established economic growth approach is not sustainable in the long run, even for rich countries. While this is the case for rich countries, third-world countries should avoid such a policy approach. Sustainable development should be examined because sustained growth is the opposite of sustainable development.

2. If there is an issue that needs to be taken into account while forming global policies today, it is the limit of our planet in providing natural resources for production and maintaining its existence with the level of pollution. The current mass consumption habits of Europe and North America cause the unequal distribution of the world's resources. However, by limiting the opportunities of the majority, the minority can live in excessive consumption and development.

3. Development policies determined by the market or the central government have prioritized economic growth for years at any cost. Although most of the third world countries have achieved high and long-term growth, they have not made any progress that will improve the quality of their daily lives. On the contrary, the growth-based development and modernization process has separated traditional people from the life they are used to but has not provided the promised opportunities.

These criticisms of the current growth policies have allowed the concept of development to be reviewed and redefined with expressions such as individual-centered development and ecological development. It has come to the fore that growth should be more inclusive and environmental pollution should be at the center of policies.

The transition from a growth-based development approach to a sustainable development approach that prioritizes nature and people can be considered as an important paradigm shift in development economics.

2.1. Steps Taken for Sustainable Development

In the process that started with the problems and environmental effects of the established growth approach, many international conferences were held and agreements were signed. Some important agreements and conferences are most cited in the literature and are thought to form the basis for sustainable development. These can be listed as follows:

- Human Environment Conference – 1972
- World Conservation Strategy – 1980
- Our Common Future – 1987
- Montreal Protocol – 1989
- Rio Summit, Agenda 21 – 1992
- Kyoto Protocol – 1997
- New Millennium Goals – 2000
- World Sustainable Development Summit – 2002
- Rio + 20 Summit – 2012
- Paris Climate Agreement – 2015.

With the Human Environment Conference held in Stockholm by the United Nations, environmental problems were discussed for the first time on a global scale. After the conference, the United Nations Environment Program (UNEP) was established. In this sense, environmental pollution has become a problem that international organizations are officially interested in. Developments have necessitated taking international measures as well. Then, priorities were determined for the measures to be taken according to the World Conservation Strategy, which was prepared under the auspices of the UN in 1980. These priorities are; It can be listed as supporting basic ecological processes for the continuation of life, protecting genetic diversity, and using the ecosystem in a sustainable way (Öztürk, 2016: 36).

With the international developments in the environment and development issues, the World Development Environment Commission (WCED) was established in 1983 within the UN body. The report called Our Common Future, prepared by this commission in 1987, had a serious impact on society. In the report, which states that the goal of continuous growth causes environmental problems, a different form of growth that meets the social needs by combining the economy and the environment has been expressed (WCED, 1987: 49). In this sense, it is important for the concept of sustainable development. On the other hand, there are criticisms that it aims at growth in line with the requirements of the age by only rearranging its growth approach and that it is not a fully sustainable development transformation (Langhelle, 1999: 129-130).

When the ozone layer, which protects the DNA of living things on earth from the harmful rays of the sun, becomes thinner as a result of industrial activities, the risk of skin cancer in humans increases, while all living things in the ecosystem are adversely affected. Scientific studies in this sense have shown that CFCs (Chlorofluorocarbons) damage the ozone layer. In the following process, it was aimed to investigate the ozone layer and it was tried to prevent damage to the ozone layer by industrial activities. The Montreal Protocol, which entered into force in 1989, required the ratifying countries to limit the production and consumption levels of CFCs (Patlis, 1992: 182-185). Although successful results were obtained, other gases damaging the ozone layer were detected and the scope of the protocol was expanded.

In 1992, the United Nations Development and Environment Conference (UNCED) was held in Rio de Janeiro, the capital of Brazil, with wide participation based on states, and as a result of the conference, Agenda 21, which includes many action plans, was published. Accordingly, it has been emphasized that it is essential not only to address the urgent problems of the day, but also to prepare the world for the challenges of the next century, and the importance of the formation of sustainable development and environmental concerns in a way that covers each other, and the importance of consensus on this issue at the international level (UNCED, 1992). Although Agenda 21 is not legally binding, it has imposed an ethical responsibility on countries. This, in turn, prioritizes the active role of institutions not only at the international and national levels but also in the sub-regions of the countries.

Fossil fuels such as oil, natural gas, and coal, which are used in the conduct of economic activities, increase the greenhouse gas density in the atmosphere. On the other hand, the acceleration of deforestation increases the negative effects of such gases on the atmosphere. These gases, which limit the reflection of the sun's rays after they hit the earth, trigger global climate change. Climate change threatens the vital functions of all living organisms in the air, on land, and in the sea (IPCC, 2001: 2-5). From this point of view, *the UN climate change convention* was established to prevent human-induced greenhouse gas emissions from causing climate change. The negotiations, which started in 1995, were transformed into a protocol in 1997 in Kyoto, Japan. The Kyoto Protocol was opened for signature in

1998. Accordingly, countries have to reduce their greenhouse gas emissions to their pre-1990 levels until 2008-2012. However, when greenhouse gases are taken into account, developed countries come first in the emission of such gases into the atmosphere. As long as these countries do not change their approaches, the result is unlikely to change (Öztürk, 2016: 43-45).

In 2000, the UN published the 68-item New Millennium Goals on activities to be carried out on development, human rights, poverty, equality, peace, and the environment. The sustainable development-specific content of the goals can be expressed as saving future generations from the threat of condemning them to an uninhabitable planet due to today's activities. In addition, the sustainable development principles stated in Agenda 21 were referred again (UNGA, 2000).

The second summit, which was held exactly 20 years after the first Rio Summit, was again held with high participation at the international level and the importance of sustainable development and ways of living in harmony with the environment were emphasized as in the previous meetings. However, even though many meetings and agreements have been made over the past two decades, the final statement still on the same point and full of impractical statements have been disappointing.

The Paris Agreement, which was accepted with the approval of 195 countries at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties in December 2015, is considered as a historical turning point in the global fight against climate change. The agreement also claims to be an important opportunity to leave a world with a more stable, healthier planet, fairer societies, and more vibrant economies, within the framework of the 2030 Agenda for Sustainable Development (SDGs). In addition, with the Paris Agreement, a global target was established for the first time, including capacity building, resilience to climate change, and vulnerability to climate change. The agreement introduces a serious transparency and accountability framework, including bi-annual monitoring of greenhouse gas inventories and national developments. Starting from 2023, the parties will meet at "global due diligence" summits every five years to evaluate progress in emission reduction, compliance, and support provided/received (UNFCC, 2015).

Since environmental pollution has become an international agenda item and the development of sustainable development understanding, many meetings have been held and various agreements have been signed. Nevertheless, it can be said that there is a distance to be taken in carrying out our economic activities in harmony with nature.

2.2. Measuring Sustainable Development

The concept of sustainable development, by its nature, covers various fields such as environment, society, and economy and creates debates on this definition. On the other hand, how sustainable development can be measured is another area of discussion. In this sense, there is currently no standard method to be used as a basis. Nevertheless, it is important to be able to determine which of the problems in the fields of environment, society, and economy, which are included in the scope of such an important issue, has priority. Some measurement and evaluation methods available in the literature are separated from each other as economy, environment, and society-centered.

Green Accounting emerges as one of the efforts to measure sustainable development. Accordingly, Green Accounting is a way of calculating national income in a way that takes into account the changes in environmental and social capital such as economic output, natural resource consumption, and environmental pollution. Expressing the components in monetary values caused a component that has no market value, such as protecting social life, to be determined only subjectively. However, an adjusted GDP calculated in this way can indicate whether the growth is sustainable (Asafu-Adjaye, 2005: 283-286).

The paradigm shift in development economics has naturally brought with it approaches that prioritize people. As a result, a society in continuing poverty is considered unsustainable. Since improving human well-being is prioritized, human-oriented indexes such as the human development index and the human poverty index have been developed. The Human Development Index, which can be considered as the social measurement unit of sustainable development, has been published by the UN since 1990. The index is calculated using data on average life expectancy, education conditions, and average income (Al, 2019: 113-114).

Contrary to other measurement methods, environmental measurements try to reveal the negative effects of people on the environment. The indexes created and the methods applied are also developed by natural scientists, not social scientists. One of them, Ecological Footprint, was developed by Rees W. E. and Wackernagel M. (1996). The ecological footprint compares the total demand in a region with the resources that will meet that demand. For example, timber consumption is compared with the amount of forest natural resources. The resulting values are compared to each other and an index is obtained. In other words, this index shows whether people's consumption level exceeds the carrying capacity of the world (Wackernagel et al., 2002: 9266). This carrying capacity is reduced if humans deplete nature's resources faster than it can regenerate itself.

According to the index, it shows that since 1980, the demands of people have exceeded the level that nature can meet (WWF, 2006: 2-3).

Environmental pollution, which is considered a common problem of humanity, and climate change, are not only an environmental dimension but also sit at the center of economic life. As mentioned, the problem of environmental pollution, which caused the fundamental transformation of development economics, revealed the importance of sustainable development. Although it has a history of about 50 years, it can be said that it is far from the desired point in terms of sustainable development. There is a central banking approach with a well-defined framework in terms of the mainstream economics literature. Despite this, the central banking framework was reshaped in the post-Global Financial Crisis period and various discussions were opened. From this point of view, the possible role of central banks in a policy-making process compatible with the natural balance of the world will be discussed in the following section.

3. Sustainable Development as a Central Banking Goal

"What is central banking?" The answer to the question is not as simple as it seems. Central banking has undergone many structural transformations since its establishment. In this context, there are serious differences between today's central banking understanding and the understanding at the time it was founded. To make a general definition, the central bank is *"in charge of issuing banknotes on behalf of the state and putting these banknotes into circulation; Responsible for maintaining the value/reliability of the national currency, meeting the liquidity need in the economy; Although it is an institution of the state, it is a non-profit bank that is independent of the government but works in harmony with the government".*

3.1. Central Banking in the Historical Perspective

States have faced great difficulties in borrowing money to finance the wars in the last three centuries. For this reason, countries have resorted to borrowing from banks that have the authority to issue banknotes. However, the intensive issuance of banknotes to meet the war expenses caused quite high inflation, and the legal restriction of commercial banks that had the authority to issue banknotes was taken. It has been understood that monetary stability will be ensured with the legal regulations; By removing the banknote issuance powers of commercial banks and giving this authority to a single bank, the way to central banking was opened (Capie et al., 1994: 5).

Undoubtedly, there are many reasons for the emergence of central banking. In general, taking the issuance of banknotes under control (Oktar, 1996: 25); change and increase in the functions of money and its effectiveness in economic life (Aktan et al., 1998: 108); The inadequacy of public revenues in meeting the increasing public expenditures as a result of a process of evolution from the "police state" phenomenon to the "social state" phenomenon over time (Akyazı, 1994: 9) can be listed as the main reasons.

In parallel with the developments in the economic conjuncture, important developments and transformations have also been experienced in the central banking sector. For example, in the period when the gold standard system was implemented (1873-1914), the primary purpose of the central banks was to maintain the convertibility of the national currency to gold. This discipline is aimed to protect both the internal and external value of money (Önder, 2005: 13).

When the history of central banking over three hundred years is examined, it can be said that perhaps the years in which the most progress, structural transformation, and modernization process were experienced were the years after the collapse of the Bretton Woods system. In this period, which is considered the beginning of modern central banking, the development of central banking moved in parallel with the changes in technology, financial system, and economic structure. There have been significant transformations in the policy goals and instruments, strategies, practices, and institutional structures of central banks. From this point of view, Posen (2004) stated that central banking should be examined in four different periods in this period. These periods and economic motives can be listed as follows: First period, 1970-1979 stagflation; second period, 1979-1987 disinflation; third period, 1987-1999 financial liberalization and fourth period; It is global production after 1999. The aim of the monetary policy in the first three periods was to provide full employment, fight inflation, prevent financial crises, and find solutions to the experienced crises, respectively. In the fourth period of central banking, there has been a shift towards the accountability of central banks with a single target and single instrument policy.

Central banks aim to achieve various objectives determined by the policies they implement. In this context, the aims of monetary policy in the historical process are generally the stability of the general level of prices, financial markets, interest rates, foreign exchange market and balance of payments, high employment level, sustainable economic growth, etc. can be listed as.

In the early years of central banking, especially in the era of the gold standard, the main purpose of central banks was to preserve the convertibility and value of money. In the following years, especially since the Great Depression, reaching high employment levels and realizing economic growth within the framework of Keynesian policies have been the primary goals of central banks. The fact that governments resort to central bank resources to achieve these goals is also an indicator of the interventionist nature of this period. Monetary view, which became dominant as a result of the collapse of the fixed exchange rate system and the failure of monetary policies in line with Keynesian policies implemented in the early 1970s to prevent inflation and stagnation, emphasized that the main purpose of central banks should evolve into the fight against inflation, together with the phenomenon of inflation experienced throughout the world (TCMB, 2012: 4-7). This requirement led to the rapid spread of monetary policy practices based on the inflation targeting strategy.

There are several reasons why inflation targeting, which was started to be implemented in New Zealand in 1990, is so accepted and applied almost all over the world. The first reason is the failure of exchange rate-based regimes implemented before inflation targeting. In addition, the currency crises caused by speculative attacks in this period made the inflation targeting regime popular. In this way, it is aimed to re-establish the trust in monetary policies with transparency, accountability, and communication policies, which are the cornerstones of inflation targeting, by making a fresh start to monetary policy with a new monetary strategy (Frankel, 2012; Akyazı and Al, 2015: 388-389).

However, after the Global Financial Crisis, the inflation targeting regime began to be questioned and new searches were made in monetary policy. The debate on this issue is shaped on whether inflation targeting is still the most optimal monetary policy regime among monetary policy strategies and what new alternatives could be, where other important macroeconomic objectives will be melted in the same pot. The focus of criticism is that the inflation targeting regime focuses too much on price stability and the desired successes are not achieved on other critical parameters. In this context, discourses came to the fore regarding the necessity of a monetary policy regime that would include price stability as well as other economic objectives. Therefore, it is possible to say that with the Global Financial Crisis, academic literature has emerged, which argues that central banks should be more effective not only in targeting inflation but also in achieving other important macroeconomic targets such as growth and employment (Mangır and Ertem, 2016: 177).

3.2. Green Central Banking for Sustainable Development

These transformations that central banking has undergone in the historical process have been shaped as a result of serious but often bitter experiences. Despite this, the ongoing debates after the Global Financial Crisis still have not differentiated central banking from the mainstream teachings. Nevertheless, central banks, with their regulatory oversight on the financial system, loans, and money, can play an active role in policymaking that takes care of environmental issues and become an active position for sustainable development. The role of central banks is important in greening the financial system itself, and thus growth, by encouraging resources in sectors with traditional carbon emissions for green investments (Ryan-Collins and Dikau, 2017: 7). According to Çevik and Jalles' (2020: 13) study, which controls for macroeconomic factors, 1 percent increase in climate change vulnerability leads to a 3.11 percent increase in the long-term government bond margins of emerging market economies, while 1 percent improvement in climate change resilience reduces bond margins by 0.75 percent. This study shows that climate change threatens macroeconomic stability and should be followed closely by central banks in order to achieve sustainable development goals. According to Volz (2017), whether central banks actively use their powers to make the economy greener depends on two factors. These; the extent to which it can best address certain types of market failures, taking into account the legal authority and capabilities of financial institutions.

Today, it has been stated that the main target of central banks in developed economies is price stability. However, in some cases, ensuring financial stability can be added to this narrow jurisdiction. As stated before, a central bank that makes policy using the single-purpose, the single-instrument method can still be expected to assess climate change and environmental risks. However, existing structures do not oblige them to go further than this and encourage a broader perspective that will increase social benefits, such as sustainable development and green finance. It is known that the areas of jurisdiction of central banks in developing countries are wider. Therefore, it may be useful to use such a mandate as a central bank that oversees environmental risks and sustainability. In this sense, central banks can be given the authority to prioritize sustainability. The point to be considered for this authorization is that central banks do not move away from a healthy balance sheet structure (Dikau and Volz, 2018: 4). Therefore, if central banks are going to experience a green transformation to contribute to sustainable development, this can be achieved by granting powers whose boundaries should be carefully determined.

On the other hand, this green transformation may not be realized only if central banks and financial institutions play an active role and encourage sustainable green investments. It will also require restricting the financing of environmentally harmful activities. In conditions where there is no public intervention in the market, firms try to maximize their profits in their investment decisions. This trend directs firms' resources towards carbon-intensive activities that have high returns but lack social and environmental benefits. This huge gap between environmental and social benefit and the benefit of the firm represents a market failure that requires public intervention to increase efficiency. In this sense, the intervention of central banks in the markets, however, should not be considered as the first choice. To address market failure, Volz (2017) states that developing a carbon emissions pricing mechanism that includes the environmental and social costs of carbon emissions is a better option than direct central bank intervention. However, it takes time for such policies to be enacted and enforced (Dikau and Volz, 2018: 4-5).

As stated, the investment decisions of firms and the allocation of resources can be influenced by central banks and other regulatory agencies. In particular, the effects and control capabilities of central banks on the system arising from their powers are high. Therefore, the policy tools that central banks will use to realize the above-mentioned factors are also important. *It is possible to collect these policy tools under four headings:* micro and macro-prudential regulations, the development of financial markets, the allocation of loans, and the guiding power of central banks.

Micro and macro-prudential regulations: Financial institutions and banks' macro perspectives on the overall system are limited due to a lack of knowledge. This causes environmental risks and natural disaster risks not to be properly priced and positioned by the mentioned institutions. Central banks can regulate to solve the problems of banks and financial institutions arising from this lack of information. If all institutions are made obligated/transparent to inform the public about, for example, how and how much they fund environmental activities, the mentioned risks can be reduced (TCFD, 2016).

On the other hand, if a standard can be established on environmental and social risks, financial institutions can reorganize themselves according to these standards. For example, banks may tend to lend according to these standards (Dikau and Volz, 2018: 6). Another micro-prudential regulation that can be evaluated specifically for banks may be on mandatory reserves. Rates can be lowered for green financing that takes care of environmental risks in mandatory reserves. Therefore, banks may find it more attractive to lend to sectors with low carbon emissions rather than to energy-intensive sectors (Rozenberg et al., 2013: 6-7).

Dikau and Volz (2018) suggested climate change-induced stress tests as macro-precautionary regulation as well as micro-precautionary regulation. Accordingly, the potential effects of natural disasters on the overall economy and the stability of the financial system will be evaluated. Moreover, this will enable the detection of macro vulnerabilities and policy-making accordingly.

Another macro-prudential policy tool is the capital adequacy ratio. This ratio is roughly the ratio that banks hold enough capital to cover the credit risk, operational risk, and market risk they face. The capital adequacy ratio can be calculated by assigning higher risk weights to carbon-intensive assets within the framework of sustainable and environmental policies. If such a policy tool is used, the carbon risk will be priced more accurately by financial markets (Schoenmaker and Tilburg, 2016: 8). In addition, direct limits can be imposed on the loans that banks will extend to carbon-intensive industries.

The sophistication of financial markets: Financial markets are considered as another area where central banks can play a regulatory and supervisory role. In this sense, central banks can direct financial institutions to green finance. For example, a green bond can be issued. For this, central banks can determine the procedures to be applied and green bonds can be issued if a low carbon-intensive investment will be made according to the investment projects to be realized (Dikau and Volz, 2018: 9).

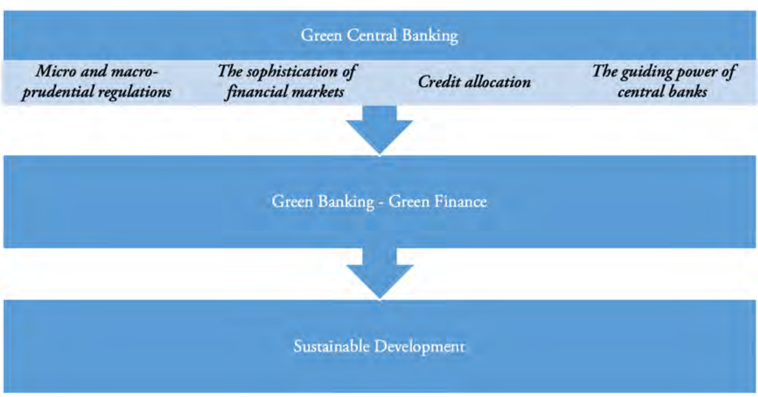
Credit allocation: Another important area in which central banks can innovate for the green transformation of the financial system is loan allocation. For example, a lower limit can be set for green loans. Therefore, banks have to give loans to green investments at least at a certain rate. On the other hand, an upper limit can be set for credits to be given to carbon-intensive industries. Similarly, it is possible to use interest rates. Central banks can directly influence banks' lending rates to encourage green finance. For this purpose, loans to carbon-intensive industries can have high-interest rates and low-carbon-intensive industries can have low-interest rates. Another method is considered a development bank. Such a bank can play a key role in green transformation. It is thought that the loans they will provide for long-term investments will be beneficial if they are given according to their sustainability and environmental pollution values (UNEP, 2016: 17).

The guiding power of central banks: as stated before, central banks can take steps to achieve sustainable development and green transformation goals and can be guided, due to their privileged position in the financial system. Central banks can give the necessary signal to the financial sector for sustainable development goals by considering environmental risks and climate change problems. In this sense, many central banks have studies that draw attention to climate change and its macroeconomic effects.

The annual growth of 3-4% of the global economy, even if it decreases in certain periods, is a very serious macroeconomic indicator. However, this growth on a global scale is far from sustainable. In most countries of the world, growth mostly occurs by distorting the income distribution justice. In addition, it seriously harms the environment. At the point reached with such a growth model, global climate change can be considered as the most important factor threatening the world. It cannot be thought that the steps taken to reduce environmental risks will not cover the economy (Sachs et al., 2019: 1-2). Therefore, together with the methods and tools mentioned above, central banks can also play an active role in this forced transformation process. On the other hand, the central banks' understanding of price stability, which is the main target, may have to change due to this role it can assume.

Generally, the green transformation of central banking is important for achieving sustainable development goals. A central bank using the policy tools mentioned above can encourage green finance by influencing the financial sector. This ongoing process can move the economy from carbon-intensive production to non-carbon-intensive production. Ultimately, a significant contribution to the sustainable development goals will be made and in this sense, macroeconomic stability will be observed. The process expressed is shown in Table 1.

Table 1: From Central Banking to Sustainable Development



4. Conclusion

There are many reasons for the emergence of central banks. These reasons are not independent of economic necessities and priorities. The institutional structures of central banks and the economic policies they implement are shaped by the economic conditions and political and social structures of the countries. Therefore, the economic priorities of the countries, their political structure, etc. as central banks change, there are also transformations in the structure, duties, goals, and instruments of central banks.

Environmental pollution and the accompanying climate change have become an important issue to be followed for the financial sector, especially the central bank. Insufficient progress against global climate change has caused many environmental disasters affecting economic life. Therefore, it can be said that environmental risks have now become a macroeconomic and financial stability problem. The institutional structures of today's central banks, which only prioritize price stability, should be reorganized to meet this need.

In this study, attention is drawn to four different methods for the contribution of the central bank to sustainable development. The first of these methods is the micro and macro-prudential policies of central banks as a regulatory institution. Second, central banks can direct financial institutions towards green investments. It can facilitate the procedures to be determined for investments. Third, while central banks facilitate investments that will contribute to sustainable development, they can make investments that will not contribute to sustainable development more difficult. Lastly, a central bank that has added sustainable development to its agenda can lead the financial markets directly with this behavior. In order for these methods to be implemented, the institutional structures of central banks that only target price stability should be reviewed.

The institutional structure, purpose, and tool set of central banks vary according to the priorities of the countries. For this reason, rather than universal criteria, the internal dynamics of countries and climate change, which has become a priority problem on a global scale, should be the most important factor determining the institutional structure and aim/tool set of central banking. On the other hand, redesigning the inflation targeting of today's consensus monetary policy strategy in a way to include objectives such as environmental pollution, sustainable growth, and development, financial stability, etc., will enable economic problems to be addressed more comprehensively and help the policies to be developed in this context to be more functional.

Finally, such a transformation by central banks cannot be accomplished independently of the government and institutional structure. In this sense, it is essential that the economic policy and social policies as a whole act in parallel with the sustainable development goals.

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10

Examining The Role of Financial Development in Agricultural Credits and Sustainable Development Relationships

Hikmet Akyol (Gumushane University)
ORCID ID: 0000-0001-9119-7416
hikmetakyol76@gmail.com

Abstract

Supporting the agricultural sector in developing countries contributes to improving the socio-economic levels of rural people, meeting the food needs of the urban population, and fulfilling long-term sustainable development goals. In addition, the development of financial markets facilitates access to agricultural financing and speeds up the development of agricultural technologies, increasing productivity in agricultural production. This research examined the relationship between the rates of use of agricultural credits and sustainable development in 44 countries selected from the example of developing countries in the period 2002-2019. In addition, the extent to which financial development supports agricultural credits and what role it plays as a moderator in the relationship between agricultural credits and development has been questioned. The results of the research showed that the developing agricultural sector due to increased agricultural credits increased the sustainable development of research countries. The research also examined the impact of the development of the financial sector on sustainable development and agricultural credits. The results showed that the increase in financial development in these countries positively affected the agricultural sector. The impact of financial development on sustainable development was found to be negative and meaningful. However, it has been found that financial development supports the positive impact of the agricultural sector on sustainable development in developing countries.

Keywords: Agricultural Credits, Sustainable Development, Financial Development, Financial Deepening.

JEL Codes: E00, E60, G00, G29.

1. Introduction

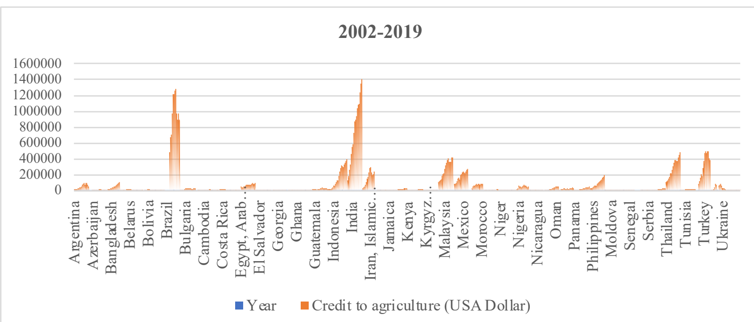
The agricultural sector has a key role in sustainable development. Therefore, issues involving agricultural production and sustainable development have been discussed at the national and international levels for decades (Davis & Langham, 1995:21). Within the framework of the 2030 Sustainable Development Agenda adopted by the United Nations member states in 2015, the 17 sustainable development goals (SDGs) are given a broad place in the targets related to the agricultural sector (https://sdgs.un.org/goals, Rao et al., 2018:1). In addition, the COVID-19 pandemic and global climate change have brought agricultural policies back to the center of national politics. These policies, which emphasize food security and aim to increase agricultural production and make it sustainable, also form an indivisible part of sustainable development by committing to maintaining the welfare level of society. Financial markets are an important tool that helps implement these policies. This concept can be defined as the development of the financial system through the increased effectiveness of the functions of the financial system (Oner, 2007:136). Financial development (FD) facilitates access to the funds needed in the agricultural sector, encourages technological development, and enables sustainable agricultural production. The development of financial markets can contribute to the fight against hunger, especially in poor countries. According to the FAO (2017), 653 million people will continue to be malnourished if pro-poor development is not given priority by 2030. In this research, the relationship between the use of agricultural loans, financial development, and sustainable development in developing countries was examined. In the study, it was tried to determine the extent to which increased agricultural loans support sustainable development. In addition, the role of financial markets in the relationship between agricultural production and sustainable development has been attempted to be shown. The research is comprised of four parts. In the first part, a conceptual framework for the variables used in the research is given. In the second part, the research made in the literature is mentioned. In the third part, the data set of the research is given, and the econometric method used is explained. The findings of the econometric analyses used in the fourth part were given.

2. Conceptual Framework

The concept of sustainable development includes long-term goals aimed at the economic development of societies and social as well as environmental development. In the Brundtland (1987) Report, these objectives were defined as the ability to make development sustainable in order to ensure that existing needs are met without compromising the ability of future generations to meet their own needs. The agricultural sector plays an important role in the fulfillment of these goals. It is necessary to increase the welfare level, especially for rural people, to ensure food security for other segments of the population, and to achieve sustainability in agriculture in order to protect the environment, as well as to fulfill the sustainable development goals (Kociszewski, 2018:1120). In developing countries, the agricultural sector is one of the most strategic sectors of the economy. Theoretical approaches to poverty have suggested that agricultural growth is necessary for poverty reduction in countries where the majority of the poor, such as India, live in rural areas and depend directly or indirectly on agriculture (Rao et al., 2018:1). Because this sector has the potential to stimulate or accelerate economic growth, which can lead to long-term economic development (Okunlola et al., 2019:467). For this reason, the agricultural sector is one of the main elements of economic growth, development, and poverty elimination in developing countries (Sertoglu et al., 2017:547). Increased agricultural production and sustainable development of agriculture are consistent with the Millennium development goals set by the UN. Sustainable agriculture includes not only the identification and implementation of advanced technologies but also the inclusion of ecological and socio-economic issues (Jose, 2009:104).

A financial sector is an important tool in fulfilling sustainable agriculture and development goals. Emerging financial markets allow farmers to invest in the agricultural sector and use new production techniques that increase agricultural productivity (Kadanalı & Kaya, 2019:234). Figure 1 shows the number of credits given to the agricultural sector in developing countries during 2002-2019. Credit rates are higher in rural developing countries such as Brazil and India than in other countries.

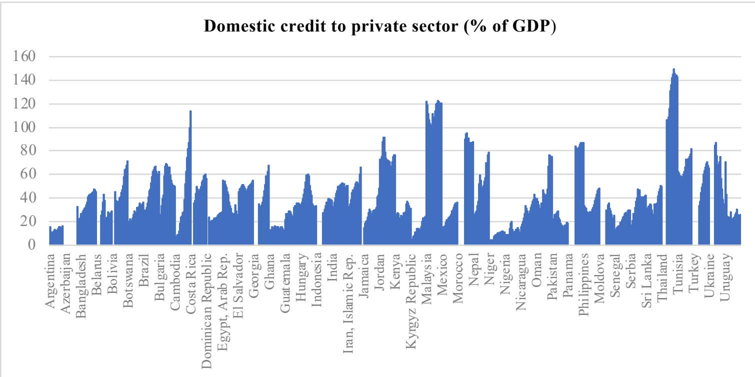
Figure 1: Credits to Agriculture in Developing Countries (USA Dollar)



Source: UNFAO, https://www.fao.org/faostat/en/#data

Besides increasing productivity in the agricultural sector, FD and increased agricultural credits support technological innovation used in this sector and reduce unemployment (Shahbaz et al., 2011; Chisasa & Makina, 2015; Olowu et al., 2019; Liu et al., 2021). In this research, the rate of financial deepening (the ratio of loans to the private sector at home) was used to represent the FD levels of the countries. Figure 2 provides the level of development recorded by the financial system in developing countries in the period 2002-2019.

Figure 2: FD (Deepening) Rate in Developing Countries During 2002-2019



Source: World Bank, https://databank.worldbank.org/source/world-development-indicators

There is a close relationship between FD and sustainable development. The United Nations (2016) has stated that savings, private finance, and capital markets worldwide can play an important role in helping to close the funding gap needed for sustainable development goals. Financial markets have basic functions such as mobilizing and allocating savings, maintaining investment control, facilitating risk management, and facilitating the exchange of goods and services (Öner, 2007:138). In this respect, FD supports the economic dimension, especially development. In his study, Patrick (1966) tried to explain the relationship between financial development and development through the concepts of "supply-leading" and "demand-following". The supply-leading hypothesis suggests that FD leads to economic development. According to this hypothesis, development occurs when financial institutions accumulate savings and turn them into investments for the development of certain sectors of the economy (Čižo et al., 2020:646). The demand-following hypothesis argues that economic development will lead to FD. Accordingly, when the economy grows, it creates additional demand for financial services that cause financial development (Gezer, 2018:98). Demand-following occurs when external financing is needed to sustain this development (Čižo et al., 2020:646). Contrary to these two hypotheses, some opinions argue that there is a negative relationship between FD and economic development. These approaches have argued that the actions of opening and reviving the financial system in general, and especially the banking system, will reduce economic growth and therefore lead to financial instability and the spread of banking crises (Aydi &Aguir, 2017:196).

3. Literature

Xuezhen and Feng (2010) tested the relationship between economic growth and agricultural growth in China between 1952 and 2007. The study, which used regression analyses, demonstrated a positive relationship between agriculture and economic growth.

Anwar et al. (2011) examined the relationship between sustainable economic development and FD in Pakistan from 1973 to 2007. In the study using the ARDL bounding test method, it was determined that there is a co-integration relationship between financial sector indicators and sustainable development. The results showed that in the short and long term, the financial sector has a positive effect on sustainable economic development.

Shahbaz et al. (2011) analyzed the relationship between FD and agricultural growth in Pakistan in the period 1971-2011. The study, which used ARDL and Granger causality analyses, demonstrated a long-term relationship between variables.

S.A.J. and Maduekwe (2013) examined the relationship between agricultural financing and economic growth in Nigeria between 1972 and 2007. The study, which used OLS and Granger causality analyses, demonstrated a two-way causality relationship between agricultural financing and economic growth.

Chisasa and Makina (2015) estimated the relationship between bank credits and agricultural production in South Africa between 1970 and 2011. The study, which used Johansen co-ordination and ECM tests, demonstrated a long-term relationship between bank credits and agricultural production. ECM results revealed that in the short term, bank loans had a negative impact on agricultural output, reflecting corporate credit uncertainties in South Africa.

Alrabadi and Kharabsheh (2016) examined the relationship between financial deepening and economic growth in Jordan between 1992 and 2014. The research, which used VAR regression, Granger causality, and Johansen-Juselius co-integration tests, found that short-term financial deepening had no meaningful impact on economic growth. The co-integration test results showed a long-term relationship between the variables. Granger causality test results showed two-way causality between financial deepening and economic growth.

Aydi and Aguir (2017) tested the relationship between FD and economic growth in Southern Mediterranean countries in the period 1981-2014 using VECM and Johansen co-integration tests. Researchers have shown a long-term co-integration relationship between FD and economic growth. Impulse-Response analyses have shown that domestic and private sector credits significantly affect economic growth.

Sertoglu et al. (2017) examined the contribution of the agricultural sector to economic growth in Nigeria in the period 1981-2013. The study using the Johansen co-integration and Vector error correction model has shown that GDP, agricultural output, and oil leases are associated in the long term. In addition, agricultural production has been found to have a positive effect on economic growth.

Bist (2018) estimated the relationship between financial development and economic growth in 16 low-income countries outside Africa in the period 1995-2014 with the help of panel data analysis method. Researchers have shown a long-term co-integration relationship between FD and economic growth. In the majority of research countries, FD has a positive effect on economic growth.

Gezer (2018) examined the relationship between financial deepening and economic growth in selected upper and middle-income countries in the period 1987-2015. In the study using panel causality tests, it was shown that countries can be clustered according to the supply-leading and demand following approaches. Researchers have found evidence of two-way causality for some countries.

Kadanalı and Kaya (2018) analyzed the relationship between FD and agricultural growth in Turkey in the period 1996-2018 using OLS estimators. The study has shown that total credits have a positive effect on agricultural productivity.

Okunlola et al. (2019) examined the relationship between agricultural financing and economic growth in Nigeria in the period 1981-2017. In the study using the ARDL estimator, it was determined that agricultural financing had no meaningful effect on real GDP.

Olowu et al. (2019) examined the added value of the agricultural sector and the impact of FD on unemployment in South African countries between 1995 and 2015. In the study using panel data analysis, it was shown that both agricultural added value and FD are important determinants of unemployment within the region. It was determined that agricultural added value is negatively related to unemployment in both the short and long-term periods, but the long-term effect is many times greater than the short-term effect. Researchers have shown that in the long term, both financial depth and financial efficiency are negatively associated with unemployment.

Ademokoya (2020) tested the relationship between the financial sector and sustainable development in Nigeria between 1986 and 2015. The study using PCA and ARDL bound testing methods has shown that the banking and stock market sub-sectors promote sustainable development in Nigeria, while the insurance sub-sector only directs sustainable development in the short term.

Čižo et al. (2020) examined the relationship between FD and economic growth in EU countries between 1995 and 2017. Researchers have shown a close relationship between FD and GDP per capita in EU countries. Accordingly, there is a positive relationship between FD and economic growth.

Ghimire et al. (2021) estimated the impact of agricultural trade in Bangladesh on economic growth and environmental pollution in 1972-2019 using ARDL estimators. The research findings did not support the hypothesis that agricultural trade causes environmental pollution in the long term. In addition, economic growth has shown a long-term and positive relationship between energy and FDI towards agricultural environmental pollution.

Liu et al. (2021) tested the relationship between rural FD and agricultural technological innovation in 33 cities in China between 2003 and 2015. The study, which used panel regression estimators, demonstrated that rural FD has a positive impact on the level of agricultural technology innovation. Research findings have shown that rural financing efficiency has a positive impact on innovation in regions with low marketing levels, while rural finance scale positively affects technological innovation in regions with high levels of marketing.

Semin et al. (2021), in the period 2001-2019, tried to establish an econometric model to determine the conditions for providing the balanced development of the environmental, economic, and social components of the Russian agricultural sector in the Eastern European region. Researchers have shown that innovation for Russia and Eastern European countries is one of the important factors in providing the sustainable development of agriculture in the region.

4. Method and Data

In this section, the framework and nature of the data set used in the research are given, and the econometric analysis method used is explained.

4.1. Data

This research examined the relationship between the rates of use of agricultural credits and sustainable development in 44 countries selected from the example of developing countries in the period 2002-2019. In addition, the extent to which FD supports agricultural credits and what role it plays as a moderator in the relationship between agricultural credits and development has been questioned. In the study, gross domestic product value per capita (GDP, USD Dollars) was taken according to purchasing power parity representing sustainable development. Total credits to the agricultural sector (USD Dollars) were used to represent agricultural credits. Domestic credit rates to the private sector in Turkey (% of GDP) were used to represent FD (deepening). In addition to population and capital formation variables, agriculture, forestry, and fisheries were used as value-added control variables in the study. The variables used are described in Table 1.

Table 1: Research Variables

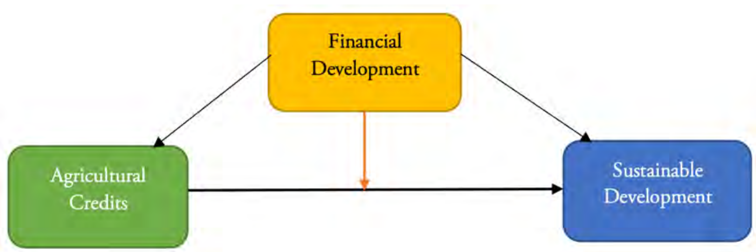
Variable	Description	Type	Source
LN (GDP)	GDP per capita (PPP, US dollar)	The natural logarithm is taken.	World Bank
LN(AGR_CREDIT)	Credits to the Agriculture (Total credits, US $)	The natural logarithm is taken.	UN FAO
FIN_DEEP	Domestic credits to the private sector were used to represent financial development (deepening) (% of GDP)	The ratio to GDP is taken as.	World Bank
LN (AGR_VADD)	Agriculture, forestry, and fishing, value added (constant 2015 US$)	The natural logarithm is taken.	World Bank
POP	Population growth.	Annual percentage change rates were used.	World Bank
INVEST	Gross fixed capital formation.	The ratio to GDP is taken as.	World Bank

4.2. Method

In the study, the econometric relationship between variables was analyzed using Driscoll-Kraay (1988) fixed effects estimators with standard errors and fixed effects estimators with clustered standard errors recommended by Arellano (1978), Froot (1989), and Rogers (1993). Driscoll and Kraay

(1998) proposed a nonparametric covariance matrix estimator that is resistant to general forms of spatial and temporal dependence and produces consistent standard errors in the presence of heteroskedasticity and autocorrelation (Hoechle, 2007:282). Similarly, the AFR estimator gives reliable results in the presence of autocorrelation and heteroscedasticity problems. The model of the research is given in Figure 3.

Figure 3: Research Model



The linear form of the predicted models is defined as follows:

Model 1:

$$LN\ (GDP)_{it} = \beta_0 + \beta_1 LN(AGR\_CREDIT)_{it} + \beta_2 FIN\_DEEP_{it} + \beta_3 INVEST_{it} + \beta_4 POP_{it} + \beta_5 LN\ (AGR\_VADD)_{it} + \mu_{it} \quad (1)$$

Model 2:

$$LN\ (AGR\_CREDIT)_{it} = \beta_0 + \beta_1 FIN\_DEEP_{it} + \beta_2 INVEST_{it} + \beta_3 POP_{it} + \beta_4 LN\ (AGR\_VADD)_{it} + \mu_{it} \quad (2)$$

Model 3:

$$LN\ (GDP)_{it} = \beta_0 + \beta_1 (LN(AGR\_CREDIT) \times FIN\_DEEP)_{it} + \beta_2 INVEST_{it} + \beta_3 POP_{it} + \beta_4 LN\ (AGR\_VADD)_{it} + \mu_{it} \quad (3)$$

Here, the "β" coefficient parameters represent the " " error term and the unit and time size if "i, t".

5. Findings

Descriptive statistics on the variables used in the research are given in Table 2. As shown in Table 2, The average values of LN (GDP), LN (AGR_CREDIT) and FIN_DEEP variables are 9,085, 9,690 and 42,032, while their maximum values are 10,472, 14,155 and 149,373, and their minimum values are 6,834, 3,757 and 3,874. The average values of invest, pop and ln (AGR_VADD) variables are 22,787, 1,374 and 22,624, their maximum values are 40,632, 7,349 and 26,750, and their minimum values are 10,860, -2,170 and 18,955.

Table 2: Descriptive Statistics

	LN(GDP)	LN(AGR_CREDIT)	FIN_DEEP	INVEST	POP	LN (AGR_VADD)
Mean	9.085	9.690	42.032	22.787	1.374	22.624
Median	9.212	9.875	34.995	22.184	1.325	22.240
Maximum	10.472	14.155	149.373	40.632	7.349	26.750
Minimum	6.834	3.757	3.874	10.860	-2.170	18.955
Std. Deviation	0.780	2.054	26.535	5.645	1.218	1.603
observation	678	678	678	678	678	678

The use of multiple descriptive variables in predicted models increases the likelihood of multiple linearity problems. Therefore, the correlation relationship between variables is examined. When the correlation matrix given in table 3 was examined, it was observed that the correlation coefficients were at acceptable levels.

Table 3: Correlation Matrix

	LN(GDP)	LN(AGR_CREDIT)	FIN_DEEP	INVEST	POP	LN (AGR_VADD)
LN_GDP	**1.000**					
LN(AGR_CREDIT)	0.330	**1.000**				
FIN_DEEP	0.380	0.472	**1.000**			
INVEST	0.080	0.202	0.215	**1.000**		
POP	-0.340	0.027	-0.123	0.037	**1.000**	
LN (AGR_VADD)	-0.080	0.753	0.101	-0.032	0.039	**1.000**

In the study, the stationarity of the variables was examined using Levin, Lin, and Chu (2002), Fisher-ADF, and Fisher-PP panel unit root tests. The LLC panel unit root test is defined over three different models: constant, non-constant constant, and trend (Levin et al., 2002:4-5):

a)

Model 1: $\Delta Y_{it} = \delta Y_{it-1} + \zeta_{it}$ (4)

Model 2: $\Delta Y_{it} = \alpha_{0i} + \delta Y_{it-1} + \zeta_{it}$ (5)

Model 3: $\Delta Y_{it} = \alpha_{0i} + \alpha_{1i} t + \delta Y_{it-1} + \zeta_{it}$ (6)

Here, $-2<\delta<0$ for i=1, … is N.

b) The term error ζ_{it} is distributed independently among individuals and follows a static reverse ARMA process for each individual,

$$\zeta_{it} = \sum_{j=1}^{\infty} \theta_{ij} \zeta_{it-j} + \varepsilon_{it} \quad (7)$$

c) All i=1, ... N and t=1, ... T.

$$E(\zeta^4_{it}) < \infty;\ E(\zeta^2_{it}) \geq B_\varepsilon > 0;\ and\ E(\zeta^2_{it}) + 2\sum_{j=1}^{\infty} E(\zeta_{it}\zeta_{it-j}) < B_\zeta < \infty \quad (8)$$

Panel unit root test procedure in Model 1,

H_0: δ=0 The alternative hypothesis against

H_1: δ<0 tests the hypothesis.

In Model 2, the individual average of series (Y_{it}) does not include time trends. In this case,

H_0: δ=0 and α_{0i}=0, the opposite hypothesis, valid for all i's,

H_1: δ<0 tests the hypothesis and is $\alpha_{0i} \in R$

Lastly, in model 3, series (Y_{it}) have an individual's specific average and include a time trend. In this case,

H_0: δ=0 and α_{0i}=0, the opposite hypothesis, valid for all i's,

H_1: δ<0 tests the hypothesis and is $\alpha_{1i} \in R$

The LLC panel unit root test developed through the ADF regression model can be defined as follows:

$$\Delta Y_{it} = \delta Y_{it-1} + \sum_{L=1}^{pi} \theta_{iL} \Delta Y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it},\ m=1,2,3. \quad (9)$$

Here, a three-step procedure over "m" is defined since "pi" is unknown. In the first step, separate ADF regressions are performed for each unit in the panel and two orthogonalized residues are produced. In the second step, the long-term short-term innovation standard deviation rate is estimated for each unit. In the third step, pooled t-statistics are calculated. Fisher-ADF and Fisher-PP panel unit root tests were recommended by Maddala-Wu (1999) and Choi (2001). The models applied within the framework of these tests are as follows (Choi, 2001:251-254):

$$Y_{it} = d_{it} + X_{it}\ (i=1, \ldots N;\ t=1, \ldots T_i) \quad (10)$$

Here,

$$d_{it} = \beta_{0i} + \beta_{1i}t + \ldots + \beta_{im_i}t^{m_i} \quad (11)$$

$$X_{it}=\alpha i\, X_{i(t-1)} + \mu_{it} \tag{12}$$

Δ_{it} is integrated into a zero-order (stable). In this model, Y_{it} consists of X_{it} processes, which are non-stochastic d_{it} and stochastic. The Null hypothesis is tested as follows:

H0: αi=1 (for all i's)

The null hypothesis implies that all series contains a unit root. The alternative hypothesis considered for finite N is as follows:

H1: |αi|<1 (For at least one of the i)

Under the alternative hypothesis, some series are stationary while some are not stationary. For infinite N, the alternative hypothesis is as follows:

H1: |αi|<1 (For some i's)

This alternative, as a special case, includes the alternative accepted in LL and IPS, where the all-time series is stationary. Maddala and Wu (1999) test statistics using "p" values can be defined as follows:

$$P= -2\sum_{i=1}^{N} ln\ (p_i) \longrightarrow x^2_{2\mathbb{N}} \tag{13}$$

Choi (2001) test statistics are as follows:

$$Z= \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \phi^{-1}(p_i) \longrightarrow N\,(0,\, 1) \tag{14}$$

Here, ϕ (.) stands for standard normal cumulative distribution function and it is

$$L= \sum_{i=1}^{N} ln\ \left(\frac{p_i}{1-P_i}\right) \tag{15}$$

$$L^{*}=\sqrt{kL} \longrightarrow t_{5N+4},\ \text{here},\ k=\frac{3(5N+4)}{\Pi^2 N(5N+2)}$$

Under null hypothesis for Infinite N

$$Ti \longrightarrow \infty,\ N \longrightarrow \infty \text{ and } P \longrightarrow {}_{p}\infty$$

This means that the P test does not have a non-degenerative distribution at the boundary. In this case, the p test must be changed to have a non-degeneration-limiting distribution. Modified P test statistics:

$$Pm=\frac{1}{2\sqrt{N}}\sum_{i=1}^{N}(-2\,ln(p_i)-2)=-\frac{1}{\sqrt{N}}\sum_{1=1}^{N}(ln(p_i)+1)$$
$$Pm \longrightarrow N(0,1) \qquad (16)$$

It is calculated in the form. Panel unit root test results are given in Table 4. According to the test results, all series are stationary at the level. Therefore, the relationship between variables was examined using panel regression analysis estimators.

Table 4: Panel Unit Root Test

	LLC		Fisher-ADF		Fisher-PP	
	LEVEL	DIFFERENCE	LEVEL	DIFFERENCE	LEVEL	DIFFERENCE
LN_GDP	-3.025***	-11.138***	128.082***	260.355***	132.080***	296.405***
LN(AGR_CREDIT)	-8.597***	-11.832***	161.009***	237.741***	268.396***	260.293***
FIN_DEEP	-3.472***	-11.957***	137.899***	255.607***	112.267***	414.498***
INVEST	-3.179***	-15.342***	122.261***	313.763***	78.823	304.933***
POP	-3.526***	-14.676***	150.050***	650.961***	292.222***	609.539***
LN (AGR_VADD)	-2.527***	-22.923***	102.562	504.455***	223.431***	1102.11***

****, ** and * signs, respectively; p<=0.01, p<=0.05 and p<=0.10 showed a level of significance.*

Diagnostic test results for the regression analyses to be predicted in Table 5 are given. When applying regression analyses, F testing was used to choose between OLS and Fixed Effects (FE) forecasters. The following is defined in the form of two different models, F testing restricted and unrestricted (Tatoglu, 2016:168):

Unrestricted Model;

$$Y_i= X_i\beta_i+\mu_i \quad {}_{i=1,\ldots,N} \qquad (17)$$

Restricted Model;

$$Y=X\beta+\mu \qquad (18)$$

The model hypothesis to be tested is;

H_0: $\beta_i=\beta$, where the hypothesis is not rejected indicates that the classic model is valid. As shown in Table 5, the F test results confirmed the presence of unit effects in the predicted models. Therefore, Hausman's (1978) specifying test was used to determine whether FE or random effective (RE) forecaster was more effective in the predicted models. Hausman test results showed that the FE estimator was more effective in all models. For predicted FE estimators, whether there was a problem of autocorrelation, heteroscedasticity, and cross-sectional dependence was examined using Greene (2000) Wald, Baltagi-Wu (1999) LBI, Durbin-Watson and Pesaran (2004) CD tests. The fact that the LBI and Durbin-Watson test statistics were less than two for all models and that the Wald test statistics were below the 5% signability level of probe values ($p<0.05$) showed that the predicted models had autocorrelation and heteroscedasticity problems. However, CD tests could not be calculated because there were missing observations in the sample used. The predicted models were examined using variance inflation factor (VIF) to determine whether there was a problem with multiple linearities. The average value of VIF for all three models was found to be low.

Table 5: Diagnostic Tests

	1	2	3
F_{Unit}	665.73 (0.000)	151.46 (0.000)	661.18 (0.000)
Hausman	44.39 (0.000)	60.87 (0.000)	54.91 (0.000)
Greene (2000) Wald	7508.28 (0.000)	6211.26 (0.000)	96700.97 (0.000)
Baltagi-Wu (1999) LBI	0.441	0.345	0.157
Durbin-Watson	0.149	0.571	0.442
Pesaran (2004) CD	[a]	[a]	[a]
VIF_{Mean}	2.17	1.05	1.09

"a" could not be calculated because the panel data set contained lost data.

In the presence of autocorrelation and heteroscedasticity problems, standard FE estimators lose credibility. Therefore, the relationship between variables Driscoll-Kraay (1998) was analyzed using standard errors and AFR estimators. The estimator results are given in Table 6. The effect of LN (AGR_CREDIT), which represents agricultural credits, on LN (GDP), which shows sustainable development, was found to be positive and significant in the first and fourth models. The effect of the FIN_DEEP variable representing FD on sustainable development is negative and significant in the first model, while it is meaningless in the fourth model. When the effect of other explanatory variables on sustainable development is examined, the effect of INVEST, which represents capital formation, on sustainable development is positive and significant in the one, three, and sixth models, while it is meaningless in the fourth model. However, the effect of the POP variable representing population ratios on sustainable development is negative and meaningful in one and four models, and meaningless in the third and sixth models. The effect of the LN (AGR_VADD) variable on sustainable development, which shows the added value of agriculture, forestry, and fisheries, is positive and meaningful in one, three, and six models, and meaningless in the fourth model. The effect of financial development on agricultural credits was found to be positive and meaningful in the two and fifth models. The effect of capital formation on agricultural credits is positive and meaningful in the second model and meaningless in the fifth model. The effect of population rates on agricultural credits was found to be positive and significant in the second and fifth models. The effect of population rates on agricultural credits is positive and meaningful in the second model, while meaningless in the fifth model. Finally, the moderator role of FD in the relationship between agricultural credits and sustainable development was examined. As seen in the third and sixth models, as the level of FD increased, the impact of agricultural credits on sustainable development became positive and meaningful. Wald test statistics showing whether the predicted models made sense were found to be significant. R^2 statistics showing the rate at which explanatory variables explain variation in the dependent variable were found to be 67% in models one and four, 71% in models two and five, and 53% in models three and six.

Table 6: AFR-FE and Driscoll-Kraay-FE Standard Errors Prediction Results

	DK-FE			AFR-FE		
	1	2	3	4	5	6
LN(AGR_CREDIT)	0.189***			0.189***		
	(0.018)			(0.042)		
FIN_DEEP	-0.001***	0.024***		-0.001	0.024***	
	(0.000)	(0.001)		(0.001)	(0.003)	
INVEST	0.002***	0.020***	0.006***	0.002	0.020	0.006**
	(0.001)	(0.007)	(0.001)	(0.003)	(0.12)	(0.003)
POP	-0.036*	0.085*	-0.021	-0.036**	0.085	-0.021
	(0.019)	(0.048)	(0.024)	(0.018)	(0.052)	(0.013)
LN (AGR_VADD)	0.121***	1.932***	0.448***	0.121	1.932***	0.448***
	(0.044)	(0.196)	(0.018)	(0.136)	(0.274)	(0.124)
LN(AGR_CREDIT)			0.0003***			0.0003***
* FIN_DEEP			(0.000)			(0.000)
C	4.539***	-35.672***	-1.340***	4.539	-35.672***	-1.340
	(0.885)	(4.661)	(0.417)		(6.157)	(2.820)
ULKE	44	44	44	44	44	44
GOZLEM	678	678	684	678	678	684
WALD-F (χ^2)	1890.99***	50.18***	282.91***	22.56***	37.51***	12.32***
R^2	0.675	0.717	0.538	0.675	0.717	0.538

****, ** and * signs, respectively; p<=0.01, p<=0.05 and p<=0.10 showed a level of significance.*

LN (GDP) is the dependent variable in one, three, four, and sixth models, while LN (AGR_CREDIT) is dependent variable in two and five models.

6. Conclusion

The agricultural sector is one of the main sectors in developing countries. Supporting the agricultural sector in these countries contributes to improving the socio-economic levels of rural people, meeting the food needs of the urban population, and fulfilling long-term sustainable development goals. The recent global pandemic in the world, disruptions in supply chains, and the negative effects of climate change have shown how important the agricultural sector is within national economies. This research examined the impact of the development of the agricultural sector on sustainable development in developing countries. The results of the research showed that the developing agricultural sector due to increased agricultural loans increased the sustainable development of research countries. This finding shows that the agricultural sector is of strategic importance for development. Therefore, in order to achieve targeted sustainable development in developing countries in the future, policies to increase agricultural production must be implemented and supported. The research also examined the impact of the development of the financial sector on sustainable development and agricultural credits. The results showed that the increase in FD in these countries positively affected the agricultural sector. This finding is important because it demonstrates the strong link between the agriculture and financial sectors. The impact of FD on sustainable development was found to be negative and meaningful. Accordingly, increased FD undermines development in the long term. However, it has been found that FD supports the positive impact of the agricultural sector on sustainable development in developing countries.

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Appendix

Table 1: Research Countries

Developing Countries
Argentina, Azerbaijan, Bangladesh, Belarus, Bolivia, Botswana, Brazil, Bulgaria, Cambodia, Costa Rica, Dominican Republic, Egypt, El Salvador, Georgia, Ghana, Guetemala, Hungary, Indonesia, India, Iran, Jamaica, Jordan, Kenya, Kyrgyz Republic, Malaysia, Mexico, Morocco, Nepal, Niger, Nigeria, Nicaragua, Oman, Pakistan, Panama, Philippines, Moldova, Senegal, Serbia, Sri Lanka, Thailand, Tunisia, Turkey, Ukraine, Uruguay.

11

Investigating the Inconsistent Findings in the CSR-Financial Performance Link: Does It Really Have to Pay to Be Sustainable?

Onur İzmir (Gumushane University)
ORCID: 0000-0003-3307-9344
onurizmir@gumushane.edu.tr

Abstract

Production processes of the companies result in certain externalities to various stakeholders. CSR is a way to enhance social, economic, and environmental performance and make up for the damage occurred by the production processes and during continuation of the interrelationships with the stakeholders. More than that, CSR is a value co-creation that improve the well-being of the society, at large. Literature has been dealing with the concept of CSR in a narrow perspective and focusing on its effect on financial performance, which causes to a methodological myopia. Although a set of inconsistencies in this relationship have been detected by various studies, reasons lying behind them have not been subject to detailed research. This conceptual study aims to fill this research gap in the literature by speculating on the possible causes leading to these inconsistencies. In the light of the findings of this study, a set of propositions are developed for the future studies on CSR.

Keywords: CSR theory, Value co-creation, Consumer orientation

JEL Codes: M14, M31, Q56

1. Introduction

In the current market environment, consumers are well aware of the negative consequences of the production and marketing activities of, especially large-sized, companies on social, economic, environmental, and ethical issues (İzmir, 2021a). Starting from the very basic production processes to many other complex business activities and interrelations of the companies result in various externalities to the nature and society along with the benefits that meet the needs of the consumers.

According to Zadek (2007), consumers of today have lots of expectations from companies in relieving the pressures from the problematic areas among which many came to existence due to their business activities. Therefore, Caroll and Shabana (2010) state that the presence of the corporates in the abstract nature of the economic system has concrete social and environmental consequences. Therefore, the main argument of the proponents of corporate social responsibility (CSR) is time, money and effort should be spent by companies on the sustainability of social, economic and environmental systems of which the balance is threatened by their presence. Hence, as opposed to what neoclassical economists suggested (Friedman, 2007), companies cannot be only profit-seeking in today's conditions of the market environment.

Companies are in constant search for finding means and methods for gaining competitive advantage over rivals. Hence, some uses CSR as a marketing tool. Companies involving into CSR, on one hand, try to create projects that provide value to various stakeholders and, on the other hand, spend millions of dollars to be perceived as socially responsible (Micheletti & Stolle, 2007; Wagner et al., 2009). Fassin and Buelens (2011) emphasized that there are companies spending more resources on public relations and advertisements of the CSR initiatives than on CSR itself. According to Porter and Kramer (2006) some of these companies use CSR as a means for product/service differentiation strategy. CSR and its effects have been evaluated from various aspects in the literature, but its relationship with profitability has been subject to one the most heated arguments.

In the literature, sustainability/CSR studies have been mainly centered in its effect on financial performance (FP) with a bottom-line perspective. The link between CSR and FP has been argued since 1980 (İzmir, 2021a) and various conflicting results in this link have been argued (Cochran and Wood, 1984; Orlitzky,et al., 2003). Some studies focused on the effect of CSR on the firm value as an element of FP and supported that successfully implemented CSR strategies increase FP (Ural et. al, 2019; Karaomer and Oypan, 2020). In the literature there is no absolute consensus, but it seems as if the literature diverges toward positive CSR-FP link claims.

Although Oberseder et al. (2011) accepted that value-oriented CSR initiatives are transformed into positive attitudes toward purchase behavior for the products of the company, they emphasize that these positive attitudes toward purchase behavior are not always linked into actual purchase behavior. In that, Oberseder et al. (2011) point out the fact that the extent of the consumer evaluations of the CSR in the decision-making process and under what circumstances CSR efforts turn into a consumption act are not investigated in depth. According to Izmir and Turgut (2019), the complex relationship between attitudes and behaviors formed by CSR might be understood if a set of intervening variables are detected. The bond between CSR and a set of actual behaviors among which purchase act is one of the most important might help identify the obstacles in the formation of the CSR-FP link.

In this chapter of the book, this link shall be investigated and discussed in detail to identify the underlying reasons of the inconsistent findings and to come up with possible concrete solutions for them. Based on the literature, to overcome the problems observed in the CSR-FP link, a set of propositions will be offered for the future studies. The outline of the chapter continues with a critical review of the literature. Then, in the light of the literature, discussion and the development of a set of propositions will be made. Finally, whole chapter is summarized and suggestions for the future directions of CSR-FP studies will be provided in the conclusion part.

2. Literature Review

The attention on the sustainability issues has been paid during the last century Turker (2009a). According to Arli and Lasmono (2010), 1930s is considered as the starting point of CSR literature because the debates on the vitality of transparency and accountability issues have been started. Kim et al. (2015) mentioned that CSR debates in academia has been heated during 1980s and CSR has been considered as a way of gaining competitive advantage. During this century, various definitions of CSR have been raised and a consensus on its definition has not been reached in the CSR literature. Caroll (1999) evaluated this issue by referring to Votaw (1973) who stated that CSR "means something, but not always the same thing.".

CSR is regarded as an investment strategy due to its link to financial performance (Lin et al, 2009). Orlitzky et al. (2003) claimed that due care given to CSR helps a company develop skills for managerial readiness for turbulences caused by external environment. Moreover, Chen et al. (2008) state that it provides legitimacy and immunity against bad publicity and social problems. Therefore, Caroll and Shabana (2010) claim that CSR help "defend the reputations (pain alleviation), justify benefits over costs, integrate with the broader strategies and learn, innovate and manage risk.". However, these benefits are not homogeneous and market reactions to CSR strategies are not generic, they change depending on one industry to another. Waddock and Graves (1997) state that corporate social performance balances the cost and revenue sides because transaction costs and certain risks reduce when the relationships with the stakeholders improve. This will provide possibilities to company for premium price that will lead to the increase in the financial performance.

However, views on the link between CSR and financial performance differ in the literature due to various factors. CSR literature is highly focused on whether/if questions in this link. In that, there are three competing views, supporting either positive, negative, or non-significant association assertions. Akdeniz et al. (2021) support the view that strong environmental performance as a result of value generating CSR strategies leads to positive FP for the companies. Although majority agrees on the positive relationship argument (Waddock and Graves, 1997; Cochran and Wood, 1984), proponents of negative relationship regard CSR initiatives as a waste of resources, unfruitful efforts and sole burden for the companies involving to it (Friedman, 2007). There are also studies ending up with non-significant relationship and mixed results due to the use of various financial performance measures in one study (For example, ROE, ROS, ROA and Tobin's q etc.) (McWilliams and Siegel, 2000; McWilliams and Siegel, 2001). Given the gravity to the inconsistent results, another view supports the idea that it is inconclusive to make any comments on this relationship (Caroll and Shabana, 2010).

When it comes to the mostly recognized view (positive relationship) in this link, it has been supported during both 1980s (Cochran & Wood, 1984) and 1990s (Waddock and Graves, 1997). However, Orlitzky et al. (2003) claimed that past reviews were mainly based on narrative method, which strives to make a conceptual framework relying on the previous findings, and vote-counting method, which tabulates significant and non-significant findings in the past studies. Both of these review methods lead to certain study artefacts that plague the validity of findings. In their meta-analysis, Orlitzky et al. (2003), to a certain degree, explained the inconsistent findings in the literature by sampling and measurement errors as two important statistical artefacts, theoretical misspecifications, contingency factors and methodological differences.

Waddock and Graves (1997) emphasized bidirectionality of this relationship through slack resources theory and good management theory based on the empirical evidence. Slack resources theory suggests that companies which have superior resources can canalize them to CSR initiatives. On the other hand, good management theory claims that companies which have superior management and learning skills can only deal with CSR initiatives because harsh competitive environment requires great amount of attention, per se. Orlitzky et al. (2003) also supported simultaneity and bidirectionality of this link and called for attention on possible moderator and mediator variables that may make impacts. The moderator and mediator variables identified in Orlitzky and his collogues' study were said to be the cause of the inconsistencies in this link, to some extent.

Grewatsch and Kleindienst (2017) investigated the link between corporate sustainability (CS) and financial performance, which also comprises of CSR literature, and could only found 8 moderator/mediator variables based on the systematic review that they made. In that, they emphasized the necessity of a fresh view and novelty on this link because majority of the studies focused solely on whether/if there is a significant relationship. To fully comprehend the nature of this link and explain the inconsistencies, studies should evaluate different factors rather than "usual suspects" (For example, industry, R&D expenditure, age, size etc.). Moderators such as ownership structure, strategic orientation, size and innovation; and mediators such as intangible resources, capabilities and stakeholder response (Grewatsch and Kleindienst, 2017) identified in the literature prove business-dominant view in the CR/CSR and financial performance relationship.

Orlitzky et al. (2003) suggested reputation, another business-dominant view element, as a possible mediator in this relationship. Moreover, when due care is given to the systematic literature review of Grewatsch and Kleindienst (2017), meta-analysis of Orlitzky et al. (2003), and literature reviews and arguments of both Cochran and Wood (1984), and Waddock and Graves (1997), it can be said that dominance of business-oriented views on CSR/CS studies is quite salient on a timeline between 80s and up till current time. Another reason for the business-dominant view in the systematic literature reviews, meta-analyses and literature reviews of the authors evaluated in this research is due to the fact that almost whole literature they reviewed is shaped by business-dominant view. As a logical outcome, their findings turned out to be dominated by a business-oriented view.

Given the gravity to the fact that success of a business is measured with how satisfied consumers are (Turker, 2009b), vitality of the market (consumer)-oriented view comes out. Grönroos (1989) emphasized the importance of market (consumer) dominant view three decades ago. Therefore, insistence on the application of business-oriented view to CS/CSR studies in today's market structure is rather meaningless and could partially induce the inconsistent findings in the literature.

This business dominant approach is partly responsible for the misuse of CSR because according to Fassin and Buelens (2011), some companies act as if responsible and use CSR as a tool for their dirty strategies to build potential relationships with the consumers and gain advantage over the rivals. However, when consumers are not convinced with the sincerity of the company's CSR efforts, consumer affairs are damaged, and both the image and reputation of the company are stricken by a devastating effect (Kim et al., 2015). According to Wagner et al. (2009), inconsistencies between words and deeds of a company in its CSR practices raise doubts and cause negative impacts on consumers' beliefs and attitudes toward the company. Although many studies asserted that CSR efforts are appreciated by the consumers and commitment to the sincere CSR strategies triggers purchase act, irresponsible behaviors and hypocrisies of the companies have a much stronger impact on the decision-making processes of the consumers than the responsible and sincere acts. On the other hand, even though Oztay and Birinci (2019) supported the view that CSR is linked to positive attitudes toward behaviors for a company and its products, Oberseder et al. (2011) emphasized that positive attitudes toward behaviors do not always have to turn into actual behavior due to a hierarchical structure formed by core, central and peripheral factors. Oberseder et al. (2011) dwell on the vitality of information about and interest in CSR, financial issues and pricing strategies, pressures of peer groups, and the perception of the company in the eyes of the consumers. They imply that CSR as a stimulus in the research designs of the studies is overemphasized and mostly made so visible by the researchers that consumers are overexposed to this stimulus. However, CSR does not very often appear in the real-life purchase decisions for the consumers. Therefore, Oberseder et al. (2011) allege that the effects of CSR on consumer decision-making might have been inflated in the studies. In this line of thinking, it can be said that this inflation might also explain a certain degree of variance in the inconsistencies between CSR and FP.

3. Discussion and the Development of a Set of Propositions

Hoeffler and Keller (2002) refer to CSR as corporate societal marketing (CSM). It can be said that they have a different view on CSR compared to other authors because first of all, they regard CSR as a marketing issue rather than a sole managerial issue. That is, they acknowledged the existence and importance of individual level factors (for example, consumers' opinions and feelings). Although their work and perspective towards CSR could be regarded as a paradigm shift in the CSR literature, they could not get deserved attention. The direction of CSR studies had not changed during the following decade after they published their article. Most of the studies published following their work have not their perspectives toward CSR and insisted on looking through business lenses rather than consumers.

The mechanism how CSR works lies behind the interplay between CSR and various stakeholder groups among who consumers are the most important. Grewatsch and Kleindienst (2017) stated that more theoretical views should be embedded in the CSR literature, and they claimed that two theories that have been used so far are resource-based view and stakeholder view. Although stakeholder view looks as if it is the closest theory to explain CSR, this view offers no more than that CSR initiatives should focus on improving the welfare of the various stakeholder groups. According to İzmir (2021b), consumers are the drivers of the direction of the market and their needs, desires and demands shape the marketplace.

The teachings of marketing science suggest that consumers are substantially value-seekers and what they buy out of a market offer is not only the core product, but also experience, symbols and stories that are embedded into the augmented product (İzmir, 2021b). From this perspective, consumers would not be willing to buy experience, symbols and stories of a product that has been produced under bad working conditions by child labor, environmentally damaging processes etc. That is, owning a brand that underperforms in certain image factors does not help build a positive self-concept through the consumption behavior. Therefore, there seems to be a strong mutuality between business and consumers/customers in the CSR efforts, which have not been fully evaluated in the literature. From business side, certain resources such as time, money, effort should be canalized to CSR initiatives in order to create successful programs to relieve the pressure from the problematic areas. From consumer side, companies with a strong CSR profile should be rewarded through repeat purchase behavior. In that, the applicability of social exchange theory as an alternative view in the future CSR studies seems rather suitable.

In their comprehensive meta-analysis, Orlitzky and his collogues implied that it is misleading to try to understand the relationships within highly complex market environment through investigating direct path between CSR and financial performance. There could be lots of intervening variables that could impact this relationship. Literature confirms the possible moderator and mediator effects, yet all of them are based on business-oriented view. Just as these moderator and mediator variables are business-oriented, the number of the research is too limited, among which only 8 variables were identified according to Grewatsch and Kleindienst (2017). Studies that investigate possible moderators and mediators seem to play significant roles in understanding and explaining the link between CSR and financial performance. In that, literature has, so far, failed to integrate individual level variables, which could be the certain attitudes and behaviors of the key stakeholders toward companies. Therefore, the focus on CSR-financial link should shift from macro and meso level to micro (individual) level, where opinions of the stakeholders, among whom consumers are the key element, are taken into considerations. For instance, in a recent study on CSR- purchase intention relationship, Turgut (2020) sought the mediator effects of trust and reputation on the link between CSR and purchase intention and supported their indirect effects. However, in the context of CSR, the missing link between a set of behaviors/behavioral intentions and FP has not gained as much attention as CSR and FP link that has been mostly measured by meso level data.

Hayes (2017) states that searching for the existence of a relationship between two variables is basic research. However, more importantly in science, we try to find out the answers of "how" and "when" questions rather than "whether" / "if" questions which investigate the significance level of a relationship. Moderation analysis is a method to find answers for "when" questions, whereas mediation analysis seeks for the answers for "how". By the moderating and mediating effects of consumer-oriented (individual level) variables, it is expected that further empirical tests on the link between CSR and financial performance will provide more consistent and coherent results as opposed to the various contradicting results in the CSR literature. In this context, theoretical frameworks and empirical research that make in-depth examination and seek answers for "when" and "how" questions in this relationship should be formed. Therefore, based on the outcomes of this research, it can be stated that the studies examining the direct path between CSR and financial performance produce unfruitful inferences and do not suggest any solutions for the inconsistent findings. Therefore, studies examining indirect paths (mediating effects) and interaction effects of consumer-centric variables can play vitally important roles for the solution of inconsistent findings and better development of CSR theory.

Proposition 1: Over attention on the link between CSR and FP caused a methodological myopia.

Studies investigating the effect of CSR on FP might have failed because of a methodological myopia. They have mostly sought for the direct effect of CSR on FP where CSR and FP have been continuously measured with different variables and proxies. How and when questions in the link between CSR and FP have occasionally been directed by the researchers. It is thought that inconsistent findings might, to a certain extent, result from this methodological myopia. It seems as if the obsession of the researchers to predict the direct effect of CSR on FP has generated no productive outcomes but confusion. However, there might be a high chance to identify the reasons and mechanism lying behind the inconsistencies in this link only if questions on "when there is a relationship between CSR and FP" and "how this relationship works" are raised.

Grewatsch and Kleindienst (2017) could have only identified 8 moderators/mediators between CSR-FP relationship in their systematic literature review. Huang et al. (2020) supported positive CSR-FP relationship controlling for the confounding effect of the economic fluctuations. Addressing when and how questions would help reveal under what conditions and how CSR-FP relationship works. In that, researchers who claim there is no relationship may come to understand that CSR-FP relationship works, for example, under only certain industries, for companies with a certain size, for companies who have certain level of resources, for companies whose board of management have certain features, for industries with a certain degree of competition, for companies/industries that are at a certain stage in the life cycle etc. In a similar vein, studies determined negative CSR-FP link might come to understand that CSR have a negative effect because the company might have failed to achieve successful implementation of its CSR strategies and projects, CSR projects might have not addressed what society actually needed, public opinion on the sincerity of the CSR activities might be negative, CSR projects of the company might not pair with the image of the company etc.

Studies that supported the positive effect of CSR on FP, as the dominant view in CSR literature (Cochran and Wood, 1984; Waddock and Graves, 1997; Orlitzky et al., 2003), might come up with the results that show CSR-FP relationship is stronger if commitment, trust, and mutuality are reached, and such variables as brand equity, reputation, image and a set of positive attitudes and behaviors play an important factor to build the link between CSR and FP. There might be many factors being possible confounders that have been contaminating this relationship. Therefore, to identify the true nature of CSR-FP link, possible moderators and mediators should be considered in the model.

Proposition 2: Studies conducted on CSR-FP link have relied too much on macro and meso level of data for the cost of ignoring micro level data.

Most of the studies searching for CSR-FP link focused too much on macro data. Can CSR be measured by such static variables that do not comprise human factor and behavior? Most of the studies obviously incline toward the use of indices when measuring CSR level of the companies. However, do these indices manage to reflect the CSR perceptions of the consumers or other important stakeholders? The purpose of this question is not to resurrect the debates on whether or not the behaviors can be averaged or summed as Weiss (1962) claimed. However, the main concern accompanied by this proposition is to emphasize that these structured and business sided indices might fail to capture the ideas of the most import stakeholder, consumer perceptions. Therefore, literature should be focusing on the measurement of the CSR on micro (individual-consumer) level on which consumer/market-oriented view can be implemented. Izmir (2021a) proposes that CSR can be evaluated as the co-creation of the value together with all other stakeholders. Macro and meso level evaluations of CSR construct fail to capture consumer element as the co-producer of the value, which seem to threaten the accuracy of the CSR-FP results because most of the existing measurement tools cannot reflect this interaction between consumer and business sides. Porter and Kramer (2019) and Izmir and Turgut (2019) claimed that application of the marketing perspective from a value approach to CSR is more accurate in terms of both theory and practice. Therefore, inconsistent findings may, to a certain extent, result from the ignorance on the use of micro data where consumer perspective (and other stakeholders' perspectives) is embedded. Studies like Mishra and Suar (2010); Blasi et al. (2018) and Javed et al. (2020) can provide insights into testing CSR-FP based on a micro level data. Literature agrees on the fact that CSR is a multidimensional construct (Turker, 2009a; Costa and Menichini, 2013; Okan et al., 2015; Blasi et al., 2018); however, inherently structured proxy variables used to measure CSR on macro or meso level are destined to fail in forming a comprehensive multifactorial CSR construct.

Proposition 3: There is not any unity in the measurement of CSR, which threatens the comparability of the results and causes to incommensurability of the CSR theory.

There are lots of definitions, conceptualizations, and operationalizations of the CSR in the literature (Waddock and Graves, 1997). Votaw (1973) said that CSR "means something, but not always the same thing to everybody". What Votaw (1973) stressed almost four decades ago still echoes today and prevails in today's market structure and the literature. According to Wang et al. (2016), there are five different ways of CSR measurement. These are: (1) Fortune's "reputation ratings", (2) "content analysis", (3) "surveys", (4) "social auding database" and (5) "proxy variable" such as "corporate philanthropy" or "pollution control investment". Each of these operationalizations has their accompanied advantages and disadvantages and measuring such a wide and dispersed concept is not an easy task to thoroughly accomplish. It is thought that inconsistent findings might partly result from these complications in the operationalization of CSR. Furthermore, according to Huang et al. (2020), FP has been measured by (1) "accounting-based performance (ROA, ROE, ROS)", (2) "market-based performance (Tobin's Q, market stock returns, price-to-earnings etc.)" and (3) "perceptual measures (surveys on market share, growth, profitability etc.)". Besides different measurement strategies of CSR, these three ways of measuring FP can be considered as another important factor that contaminates the accuracy of the findings. Wang et al. (2016) claimed that the heterogeneity of CSR-FP association is disturbed and also shaped by these different operationalizations in both constructs. Wang et al. (2016) found in their meta-analysis that correlation between CSR and market-based FP is less than the correlations of both accounting and perceptual measures of FP. Furthermore, perceptually measured FP is more strongly correlated with CSR than FP measured by accounting-based and market-based approaches. Especially, disparate measurement types and operationalizations of CSR escalated the problems of accumulating the results of the different studies. Moreover, CSR as a multidimensional construct could not be reflected to the studies focusing on the CSR-FP nexus, which can be considered as another factor that causes a certain degree of loss in explaining the parameters in this relationship.

Proposition 4: CSR studies have been overwhelmingly shaped by the business dominant view although CSR is a value co-creation process.

In the implementation of consumer-oriented view, relationship marketing paradigm might be of a great use, enlarging the horizons of the future CSR studies. Vargo and Lusch (2004; 2014) place customer in the center of the transactions, put a strong emphasis on the co-creation of the value, and regard consumers as the co-producer of the value proposed to the market. Izmir and Turgut (2019); Porter and Kramer (2019) and Izmir (2021a) claimed that CSR have been long evaluated from a business perspective, but CSR is a process of co-creation of the value. In that, CSR definition of Izmir and Turgut (2019) on the basis of consumer-oriented perspective deserves attention. They define CSR as a "mutual value creation process which is shaped by the interaction/synergy established by the long-term relationship commitment and trust among various stakeholders and the business, and is supposed to be based on voluntariness and good-will in terms of socio-cultural, environmental, economic, ethical and legal aspects.". By this definition of CSR, they mean to cut CSR loose from the oppression of the business dominant view, and place CSR definitions, conceptualizations, and operationalization on the axis of value and consumer centrism. Hoeffler and Keller (2002) call CSR as corporate societal marketing (CSM) and state that companies should obtain a non-economical purpose to enhance the utility of the society by the resources of the company or companies' partners. According to Izmir and Turgut (2019), Hoeffler and Keller's (2002) approach to CSR or so-called CSM should be considered as a paradigm shift in the CSR literature because

Hoeffler and Keller (2002) regard CSR as a marketing problem rather than a pure managerial problem. Izmir and Turgut (2019) assert that when marketing is evaluated as a (young) science that is interested in the exchange of the value which creates mutual satisfaction, application of the marketing perspective on the basis of value concept to CSR seems to be more appropriate and productive than business/managerial perspectives. Izmir (2021b) states that “marketing is interested in the exchange-based relationships, developed around the value concept, which provides satisfaction to the participants. Therefore, everything that can be exchanged and hold value can be considered as marketable. Value is essential in marketing exchanges because consumers are prone to purchase more than what the core product offers, and marketing offering should provide a certain level of satisfaction. The means and methods might change over time, but the future of marketing will be around exchange relationships, symbols, value, and satisfaction.”. Izmir (2021b) stresses the vitality of consumer (market) oriented view because sustainability and success of a company is strictly dependent on highly satisfied consumers. Therefore, companies should obtain the required set of skills and capabilities to be able to see through consumer lenses to reach absolute satisfaction. On the basis of this approach, CSR should be considered more than an extra value attached to the market offering. Porter and Kramer (2019) coined the term “shared value” and proposed that business world and the CSR literature has misevaluated the value concept for the last two decades because companies define value creation in a narrow perspective that mostly focused on the short-term oriented FP and aggressive sales tactics. These short-term plans to increase FP are beyond taking needs and demands of the society into account. Companies cannot defend these short-term focused strategies that result in devastation of the consumer welfare, disruption of the natural resources by which companies produce their goods and services to be offered to the market, threatening the sustainability of the suppliers by whom production and distribution issues are handled, ignoring the problems of the communities who buy their products and generate profit for them. State policies that prioritize economic productivity over social growth can only be surpassed through corporate strategies that bring business world and society together. Porter and Kramer (2019) stated that value is obtained through subtracting benefits over costs and value cannot be considered equal to utility. Government bodies and non-profit organizations define success as the extent to which the benefit sought to be created is reached or the monetary cost to be born while generating the benefit. Similarly, companies move toward profit-orientation instead of value orientation and they calculate the profit by subtracting the costs from the revenue that they generate from their sales. However, if they all define success from value perspective, business world, non-profit organizations and government bodies would be increasing their cooperation and solidarity with each other. On the other hand, failure of the business world at understanding the shared value concept results in not taking the social issues in the center of all business operations and rupturing the social and economic bonds. According to Porter and Kramer's (2019) shared value concept, corporate policies and practices should be comprehensive enough to enrich the competition in the market as well as elevate the wellbeing of the communities with whom business is made. However, while companies intend to boost consumers' impulse to buy, they, on the other hand, strive to increase the capital for the investors by restructuring, reducing the number of the employees, moving to low-cost areas etc due to the pressure of increasing financial performance in the short run. These strategies only provide short term profitability in the financial statement, but they yield little or no benefit to the communities with whom they make business. It is unfortunate to conclude that companies keep prioritizing the short-term profit for the cost of their self-destruction because companies can survive, thrive, and sustain their operations only if they have a strong and healthy surrounding, and a supporting environment.

Proposition 5: CSR strategies and activities do not have to directly associate with profitability. A set of positive attitudes and behaviors directed toward a company through CSR should be considered as an adequate achievement and gain.

CSR strategies do not always directly turn into profit in the financial statement. CSR activities of a company provide lots of advantages in the market. CSR projects which are of great importance for the wellbeing of the stakeholders are supported to get them succeeded because these projects are expected to generate positive outcomes for them. Over the course of time, the support of the various stakeholders transforms into an increase in the demand for the companies' products, easy access to both to the capital, row materials and market, growth in the efficiency and innovative ideas, improvement of a specialized work force, optimization in the decision-making process, and reduction in the potential risks (Izmir and Turgut, 2019). Torugsa et al. (2011) stated that the sincere efforts to try to solve the problems of the stakeholders create a relationship between the company and the stakeholders on the basis of trust and commitment. These efforts on improving the wellbeing of the external environment who are not in the center of the business operations while trying to reach internal goals of the company are reworded by the stakeholders. Chowdhury et al. (2019) state that companies operating in the environmentally sensitive industries, such as oil, gas and mining, might cause an excessive damage, to the degree of an environmental catastrophe, which may even result in the loss of their license. However, if these companies sincerely involve into the proactive, environment restoring, and value generating CSR activities, they gain a unique chance to strengthen their image and legitimacy in the eyes of the stakeholders and lawmakers. Lee et al. (2019) mentioned that companies who succeeded to gain trust and a good reputation through value generating and stakeholders' welfare increasing CSR efforts affect companies' image very positively. From the aspect of internal benefits to the company, employees whose welfare have been raised through CSR projects develop high motivation, efficiency, and increased commitment to the workplace thanks to a corporate environment where democracy, flexibility and variety prevail. Moreover, skilled workforce and managers prefer to work at the companies with a strong reputation and image, so good CSR strategies indirectly create an attraction for the good employees. Creation of an innovative environment to produce valuable CSR projects encourage employees to take initiative and generate ideas freely which as a result contributes to the improvement of the products and production processes of the company (Izmir, 2021a). From the aspect of the consumers, value creating CSR efforts that have positive economic, social and environmental outcomes lead to positive brand perception, trust, commitment, reputation and image in the eyes of the consumers (Izmir and Turgut, 2019). Positive reactions of the consumers shaped by CSR is expected to increase demand for the products, reduce the elasticity of the demand and provide a chance for price premiums (Sidhoum et al., 2018). Furthermore, Izmir (2021a) asserts that companies that act responsibly toward stakeholders can offer high quality products to the market because they also improve their core business activities as a result of the increased relationships with the stakeholders who have a strategical position for the production and sustainability of the company. In that, these companies form brand equity and consumer lifetime value which equally resonate with customer loyalty, commitment, satisfaction, WoM, recommendation, purchase intention and a set of positive attitudinal and behavioral outcomes. Positive perceptions, attitudes and behaviors of the employees, consumers and other stakeholders forged by the benefits of the CSR strategies lead to an increase in the sales and profit margin.

4. Concluding Remarks

Literature suggests that there are inconsistencies identified in the studies focusing on the CSR-FP nexus. Orlitzky et al. (2003) and Huang et al. (2021) support the view that the evidence for the positive CSR-FP relationship seems stronger, yet there are other variables intervening and sometimes possibly confounding this relationship. These variables are the possible moderators and mediators that are expected to make certain impacts on CSR-FP association. Therefore, the insights gained from this research suggest that testing the relationship between these two variables is not adequate enough to understand how the mechanisms of CSR work and it affects companies' financial and/or overall performance. This limited view and simplistic models cannot successfully explain a set of outcomes of CSR and their complex interrelationships. In that, studies should turn from business-oriented approaches. Instead of discussing on what benefits CSR offers to companies, studies should diverge toward roles of the stakeholders in CSR because the main objective of CSR initiatives are to create value together with the various stakeholders among who consumers are the most important.

Studies published in the mainstream academic journals focused mostly on the profitability issues and a set of benefits derived from CSR efforts. CSR is regarded as a means and method for increasing the performance of the company and gain competitive edge over the rivals. Both theory and practice do not hesitate to ignore the efficiency and effectiveness of these CSR projects in turning into a value that makes up for the damage caused by the business activities and even improve social, economic, and environmental surroundings of the consumers and other stakeholders. A company surrounded with a healthy and strong supporting environment can excel. Strong companies should be aware of the fact that their powers are derived from the healthy internal and external environments. However, a company cannot sustain its business operations and even existence in the long run if they serve in a market where (1) consumers have a low income, and do not have needs, desires and demands developed around self-esteem; (2) suppliers cannot reach and provide quality raw materials to the producers; (3) government does not support a healthy competitive environment, loads too much unnecessary tax burden on the shoulders of the companies and causes to political instability; (4) rivals create price wars, adopt expansion strategies by vertical and horizontal integrations that hurt competitive environment, and make fake innovations and product developments; (5) employees work under bad conditions and are not motivated to spend their best effort to reach the goals of the company. To keep the wellbeing of this supporting environment, companies should not only provide quality goods/services, but also create value to various stakeholders, society as a whole, economy, and environment. In that, it can be concluded that if both internal and external environments of the company are fortified, the company elevates its position in the market and gets even stronger. Therefore, companies should not be self-centered and only interested in their own problems and goals. Mutuality is a way to establish commitment between various stakeholders and the company. Once this commitment is established, system works on the right track, and everyone wins.

The question "does CSR have to directly relate to profitability?" requires some attention to ponder over by the companies and CSR literature because it seems as if a set of attitudinal and behavioral outcomes such as brand equity, positive image, favorable attitudes, reputation, trust, commitment, loyalty, WoM, willingness to purchase, price premium, actual purchase act etc. are as equal gain as the FP itself. That is, without these elements, it can be said that a company cannot operate with full function and be expected to perform well. Hence, attitudinal and behavioral outcomes of CSR are alone sufficient enough, independent from direct profit-making. Studies should stop insisting on supporting positive CSR-FP relationship as if it is a must for the continuation of CSR activities and cast their thoughts on the effectiveness of these projects in turning to a shared value and the possibilities of the attitudinal and behavioral outcomes of CSR. In this line of thinking, it can be said that direction of the CSR studies should turn from positive CSR-FP arguments to value co-creation. Inconsistent findings suggest that the theory that supports the link between CSR and financial performance is weak because there is no consensus in the literature on this link. Just because CSR- FP relationship seems not to exist under every condition, it does not mean that theoretically this association cannot be not supported. On the very contrary, there might be methodological, conceptional and operational biases that cause the inconsistent findings. This link might be even confounded by many other intervening variables. The lost chain in this link might be fulfilled by the inclusion of a set of attitudinal and behavioral elements.

The novel marketing paradigm suggests that companies should be consumer (market) oriented to reach full customer satisfaction. Co-creation of the value is vitally significant because needs, wants and desires of the consumers are immense. Therefore, consumers want to involve into production of the value. CSR should not be seen as a pure corporate giving or voluntary activity, beyond co-creation of the value. Therefore, inclusion of the consumer side to CSR studies and practices has a potential to generate new directions in the literature and provide more insights into CSR-FP nexus. Positive attitudes and behavioral intentions developed by CSR are as important as the FP because these variables predict actual purchase behavior through which companies make profit. The purchase behaviors of the consumers aroused by CSR turn into profit through efficient and effective management mentality.

The lost chain in the relationship between CSR and FP can be repaired if questions related to when and how this relationship is developed are addresses and attitudes/behaviors aroused by the CSR efforts of the companies are embedded in this link. By this way, the complex relationships between CSR and a set of its consequences can be identified. Furthermore, a virtues circle might be created when the paths from CSR to actual purchase behavior and a set of positive behaviors towards companies involving into value creating CSR activities are formed. This path can be established if companies do not fall into corporate hypocrisy and do produce sincere and value creating CSR strategies. Over the course of time, purchase behavior and a set of positive behaviors toward socially and environmentally responsible companies would eventually be transformed into positive FP, per se. However, researchers and marketing managers should be cautious about empirical findings that support positive behavioral outcomes developed by CSR efforts because Oberseder et al. (2011) point out the fact that certain hierarchical factors make impacts on the transformation of the attitudes and behavioral intentions into actual behavior. They claim that in the research setting, researchers create an artificial CSR awareness in the participants of the study, which does not exist in their natural settings of the consumers where they decide on their real purchase behaviors. Therefore, Oberseder et al. (2011) claim that findings on CSR are, to a certain extent, inflated and emerged mostly by common method bias and the social pressure in the course of conducting the questionnaire. However, out of this argument, conclusion could be the fact that if the companies succeed in creating CSR awareness in the consumers and handle hierarchical factors properly, they can benefit from whatever advantages CSR offers.

Regardless of whether a researcher is the proponent of the CSR or not, overwhelming majority of the empirical findings suggests that benefits of the CSR to the company, stakeholders, and the environment are real under certain conditions. The fact that CSR awareness in the studies is artificial, hierarchical factors determine the transformation of the CSR to a set of attitudes and behaviors, and common method bias contaminates results does not diminish the significance of CSR. On the very contrary, it gives clear messages to both theory and practice. That is, researchers should overview their methodologies, conceptualizations and operationalizations of CSR. Practitioners should not fall into corporate hypocrisy and communicate their CSR practices with the stakeholders to create awareness and provide clear information about company's CSR projects and goals. Based on the understanding developed by this study, it can be concluded that CSR does not have to directly relate to FP, so being sustainable does not have to pay off from monetary aspects, at all. However, studies that focus on CSR-FP relationship are also important. When positive relationship argument is supported, managers can defend their CSR strategies against the pressures of the shareholders on the short-term profitability. Positive CSR-FP link helps managers convince shareholders that their short-term profit is not threatened by the resources canalized into the actualization of the CSR projects. However, no less important than the studies conducted on CSR-FP nexus is the normative studies that strive to form conceptual and methodological frameworks to shape the future directions of CSR theory and practice.

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12

The Relationship Between Transportation and Income Inequality in Some OECD Countries

Ayfer Özyılmaz (Kocaeli University)
ORCID: 0000-0001-9201-2508
ozyilmazayfer@gmail.com

Abstract

Transportation, which is the driving force in maintaining basic economic activities, affects socio-economic life in many ways. In this sense, one of the prominent effects of transportation is income distribution, which is one of the important problems of economies. On the one hand, the transportation sector provides the poor with access to job opportunities, reduces unemployment with the employment conditions, creates on a sectoral basis and increases disposable income by reducing transportation expenditures among the total expenditures of poor households. However, on the other hand, transportation also increases the wealth of high-income households providing companies with cost minimization. In this context, how transportation affects income inequality is directly related to the relative benefit it provides to income groups. In this context, the effect of transportation on income inequality is discussed in 21 OECD countries for the period 2004-2017 using panel fourier causality test and Two-Step GMM method. According to panel fourier causality test, a causal relationship was found between transportation infrastructure and income inequality. Two-Step GMM analysis results indicate that that transportation infrastructure is statistically significant on income inequality. Accordingly, transportation infrastructure increases income inequality

Keywords: Transportation, Logistics, Income Inequality, GINI

JEL Codes: L91, O18, D31, D33

1. Introduction

Transport systems are an integral part of society, the economy, and human impact on the environment and are crucial for sustainable development. The fundamental components of transportation systems are vehicles, infrastructure, and propulsion, operated by computers or humans. They provide transportation services that involve people and goods for a wide variety of functions (Gudmundsson et al., 2016).

Sustainable transportation and sustainable development have started to gain more importance with the high growth trend of many developing countries. Although economic growth is one of the essential goals of the country's economies, it is certainly not a sufficient parameter for social welfare. The aim here is to accelerate the growth rate and to accompany the development of all regions, areas, and segments of society. Achieving this goal will require improvement in various modes of transport and significant expansion (Puri, 2017).

Three main elements come to the fore in the relationship between the transportation sector and sustainable development. These are society, economy, and environment. The transportation sector has a crucial role in ensuring minimum expectations in these three parameters. Strategies such as improving road management, promoting public transport, pricing policies, using clean fuel, improving vehicle technology, cultural improvement, and transport planning can increase transport's role in sustainable development goals (Sherif, 2018).

Developments in the regional and global economy are not the only determinants in the transportation sector. The transportation sector is also affected by the positive and negative developments in different sectors such as the mining sector, the agriculture sector, the energy sector, and the tourism sector (Kalkınma Bakanlığı, 2018)

Transportation is one of the critical discussion topics of public policies. Developments in the transportation sector, directly and indirectly, affect the socio-economic life of households. Better transport, in general, promotes regional accessibility positively affects people's well-being. It provides greater and faster access to health and social services, thus alleviating social inequality. A better transport infrastructure strengthens business investment, increases competitiveness, and can accelerate a country's economic development. In this context, transportation directly affects aggregate demand and economic growth. For example, transportation infrastructure construction increases the demand for intermediate inputs from other sectors, so in a sense, the sector has a multiplier effect on the economy. In addition, the transportation infrastructure, which reduces transportation costs between the periphery and the center, increases the mobility of freight and passengers, provides the society with access to the desired resources, markets, and services, contributes to the development of rural areas and the transformation of urban areas; It prevents spatial agglomeration in cities and affects regional growth through channels such as employment and productivity (Hakim and Merkert, 2016; Pradhan and Bagchi, 2013; Li and DaCosta, 2013; OECD, 2004).

An extensive transport network means less road congestion and faster, more reliable travel times for both people and goods. Diversification of transportation options allows businesses to choose the most optimal way to send their goods. From a cost perspective, extra time spent in traffic not only wastes fuel, leading to higher out-of-pocket expenses for businesses and households, but also wastes time that could be spent on more efficient activities (NEC, 2014). Considering the extent of transportation costs in large-scale companies operating at the institutional level, the transportation sector provides these companies with global competitiveness in international trade and can significantly increase their foreign trade volumes. The cost advantage is not limited only to these companies, but also spreads to the whole society both directly and indirectly. Because cost is the most important obstacle to the use of transportation. Policies that make transport more affordable (such as concessionary wages/subsidies) can be an effective way to help people living in poverty find or stay in work (Gates et al., 2019).

In addition to being an essential component of development, the transportation sector is directly related to many parameters in the country's economy. One of these discussion topics is the relationship between transportation and environmental pollution. The prominent topics in the relationship between transportation and environmental pollution are water, air, soil, and noise pollution. At this point, the awareness of climate change, which has increased in recent years, leads to more discussion of the negative impact of logistics on the environment.

One of the essential issues regarding the effects of transportation is on inequalities. In the context of human capital and educational inequality, According to Zhou et al. (2019), transport infrastructure is an important factor in promoting regional economic development. The development of a transport network shortens the distance between different regions and reduces geographical constraints on labor migration. Therefore, the transport sector, which provides access to education opportunities, especially for rural or poor rural households, supports human capital development and can become a crucial element in reducing education inequality. Similarly, Schaffer and Siegele (2009) analyzed the relationship between transport infrastructure and human capital, noting that transport infrastructure can increase workforce capability and improve average educational attainment.

Concerning transportation inequality, one of the current debates in the literature is the effect of transportation on regional inequalities. According to Puga (2002), improving transport infrastructure reduces regional inequality. Nunn (2004) found that transport infrastructure in different countries can improve labor migration and support the development of the regional economy. Zheng and Kuroda (2013), who hold a similar view, argued that transportation reduces regional income disparities in China.

One of the integral inequalities to be discussed is income distribution. Transportation can easily change the economic geography and thus affect the financial results; therefore, it plays a vital role in reshaping the income distribution (Li and DaCosta, 2013). A developed transport infrastructure allows low-income individuals clustered in underdeveloped regions to connect to regions where basic economic activities are concentrated. (Xiaolu, 2006; Estache, 2003).

Three main factors influence the relationship between transport and inequality: i) The way people are distributed geographically and across social classes, ii) The way opportunities are distributed, including jobs and education, iii) How accessible the transportation system is in terms of cost, geographic accessibility, and time and reliability of different transportation options (Gates et al., 2019).

As far as we know, there is no study discussing the impact of transportation on income inequality in OECD countries. In this sense, it is expected that the study will contribute to the literature. In this context, the effect of transportation on income inequality is analyzed in this study with the Panel Fourier Causality and Two-Step GMM method in OECD countries between 2004 and 2017. The rest of the study is planned as follows: In section 2, following the introduction, the literature on the relationship between transportation and income inequality is discussed. In section 3, data and model are presented, and analysis findings are given in section 4.

2. Literature

Transportation is significant in the reallocation of income distribution with both its geographical effects and economic consequences (Yu and Yao, 2019; Li and DaCosta, 2013). However, there is no consensus in the literature about the direction of this effect. The determinant of inequalities in which income level households receive the most significant share from transportation. Although different channels are put forward in the studies emphasizing that the developments in the transportation sector reduce income inequalities, the common denominator is that low-income individuals will get a larger share from the developments in transportation. In this context, one of the main arguments in studies suggesting that transportation infrastructure reduces income inequality is that developed transportation networks offer job opportunities to individuals living in small city areas due to high housing prices.

Moreover, thus affecting the income levels of individuals with limited opportunities. There are many studies in the literature that support this argument. For example, Hooper et al. (2018) argued that transportation infrastructure reduces income inequalities through better job and educational opportunities in the U.S. According to the study, the construction industry plays a decisive role in this relationship. In this context, more public spending on highways leads to the growth of the construction sector; this, in turn, reduces income inequality by increasing wages and reducing unemployment. According to Hernández (2017), since the share of low-income households spending on transportation is higher in total income, developments in transportation infrastructure affect the income levels of the poor more through cost advantage. According to Mendoza and Migues (2017), who have a similar approach, improved transportation infrastructure reduces the cost of commuting and offers better job opportunities. This situation, which has a significant impact on the income of low-income households, is determinant in income distribution. However, all these beneficial contributions of transportation infrastructure to income distribution assume that access occurs under identical conditions. Supporting the same view, Calderón and Servén (2004) argued that the transportation reduce income inequalities in more than a hundred countries. In their study, they attribute this to the more substantial impact of improved transport infrastructure on the income and well-being of the poor.

Lin (2019) suggested that the effect of transportation on income inequality differs in the short and long run. In the study, they used China's provincial data from 1995-2014. Accordingly, transportation infrastructure reduces income inequality, but this only happens in case of improved employment conditions and is valid for provinces with adequate transportation infrastructure. However, according to the study, transportation infrastructure increases income inequality in the long run. On the other hand, Wang (2006) discussed this relationship with different inequality parameters. The study discussed the impact of transportation in China on both interregional and intraregional inequalities. According to the study, transportation reduces income disparities between rural and urban areas and income inequality in rural areas. In addition, it was emphasized in the study that the lack of transport infrastructure is a fundamental cause of rural poverty and income inequality in China. Li and DaCosta (2013), who also discussed the relationship between transportation and income inequality in China, revealed a negative relationship between transportation and income inequality. In this context, transportation network could reduce the gap between the rich and the poor.

Looking at the studies dealing with transportation income inequality in the context of convergence, Caruana-Galizia (2013) suggested that transportation leads to income convergence in India. According to Estache and Fay (1995), who discuss the developments in the transportation sector in the context of regional income convergence, transportation is one of the crucial determinants of income convergence for the poorest regions in Argentina and Brazil.

Despite the extensive literature suggesting that transportation will reduce income inequality, there are also studies emphasizing that transportation can deepen inequalities. For example, Mendoza and Migues (2017) argued that transportation infrastructure increases income inequality in China. According to the study, fair distribution and access play a decisive role.

Some studies deal with the relationship between transportation and income inequality in transportation modes. For example, Zhang and Zhang (2021) discussed the relationship between transportation infrastructure, economic growth, carbon emissions, and income inequality in China. According to the study, road transport negatively affects income inequality. On the other hand, rail transport reduces income inequality initially but increases later. Therefore, rail transport, which follows a fluctuating course on income inequality, converges to zero after a while. Yu and Yao (2019) analyzed the impact of high-speed rail investments in China. According to the study, high-speed train stations generally increase local income inequality, but the findings differ according to the regions. This effect is more robust in the western regions than in the eastern regions but is insignificant in the central regions. Hooper et al. (2018) argued that investments in highways reduce inequalities with the employment and wage effect in the USA. Li and Da Costa (2013) discussed the effect of different modes of transport on income inequality in China. Accordingly, road, airway, and pipeline transportation reduce income inequality. In addition, five modes of transportation (road, seaway, railway, airway, pipeline) reduce income inequality in cities. In rural areas, rail, sea, and pipeline transportation are the prominent modes in reducing income inequality. According to the study, the impact of oil and gas pipelines on income inequality is higher than other modes of transport, which shows that sustainable access to energy resources is essential for income distribution. Azzaoni and Guilhoto (2008) argue that rail and sea transport reduce income inequality in Brazil, but rail affects inequalities more strong. In the study, this result is based on the fact that maritime transport causes more job losses.

3. Methods and data

In this study, the effect of transportation on income inequalities is discussed the period of 2004-2017 in 21 OECD countries. Transportation and GINI data is very limited. For this reason, the study is limited to the period of 2004-2017 and 21 countries. In the study, first of all, Panel Fourier Causality is used to determine the causality relationship of the countries, and then for the coefficient estimation, Two-Step GMM Estimation is used. For transportation, transport infrastructure investment, which is frequently preferred in the literature, is used. The list of countries included in the analysis is given Appendix. The established dynamic econometric model is as follows:

$$LGINI_{it} = \beta_1 LGINI_{it-1} + \beta_2 LTRANSP_{it} + \beta_3 GROWTH_{it} + \beta_4 LUNEMP_{it} + \beta_5 INF_{it} + \beta_6 LTAX_{it} + \beta_7 LTRADE_{it} + \beta_8 FDI_{it} + v_{it} \tag{1}$$

Description of the variables used in the study are given in Table 1.

Table 1: Description of Variables

Variables	Description	Sources
LGINI	GINI Index	OECD, Our Data in World
LTRANSP	Transport Infrastructure Investment (Inland total, % of GDP)	OECD
GROWTH	GDP growth (annual %)	World Bank Open Data
LUNEMP	Unemployment, total (% of total labor force) (national estimate)	World Bank Open Data
INF	Inflation, consumer prices (annual %)	World Bank Open Data
LTAX	Tax revenue (% of GDP)	World Bank Open Data
LTRADE	Trade (% of GDP)	World Bank Open Data
FDI	Foreign direct investment, net inflows (% of GDP)	World Bank Open Data

The natural logarithm of all variables except growth, foreign direct investment and inflation, which have negative values, were taken and included in the analysis. The summary statistics of the variables are presented in Table 2.

Table 2: Descriptive Statistics

Variables	Obs.	Mean	Std. Dev.	Min	Max
LGINI	294	3.424	0.129	3.152	3.725
LTRANSP	294	-0.128	0.433	-1.330	1.164
GROWTH	294	2.290	3.604	-14.838	11.965
LUNEMP	294	1.918	0.392	0.810	2.969
INF	294	2.688	2.724	-1.544	15.402
LTAX	294	2.985	0.306	2.069	3.627
LTRADE	294	4.519	0.504	3.196	5.868
FDI	294	4.978	10.851	-57.605	75.148

For the causality, the panel fourier causality test is used developed by Yilanci and Gorus (2020). This test is performed regardless of the cointegration relationship between the series and whether the series is stationary or not. In this panel causality test, the effect of structural changes is taken into account by adding the Fourier function to the panel causality test proposed by Emirmahmutoglu and Köse (2011). In order to apply this test, which is called Panel Fourier Toda Yamamoto (PFTY), the following model is considered (Yilanci and Gorus, 2020):

$$y_{it} = \mu_i + \sum_{j=1}^{k_i+dmax_i} A_{11} y_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} A_{12} x_{i,t-j} + A_{13} \sin\left(\frac{2\pi t f_i}{T}\right) + A_{14} \cos\left(\frac{2\pi t f_i}{T}\right) + u_{i,t} \quad (2)$$

$$x_{it} = \mu_i + \sum_{j=1}^{k_i+dmax_i} A_{21} y_{i,t-j} + \sum_{j=1}^{k_i+dmax_i} A_{22} x_{i,t-j} + A_{23} \sin\left(\frac{2\pi t f_i}{T}\right) + A_{24} \cos\left(\frac{2\pi t f_i}{T}\right) + u_{i,t} \quad (3)$$

Here t is the trend, T is the number of observations, and f is the optimal frequency value whose value can be determined by information criteria. To test the basic hypothesis showing that there is no causality from X to Y for the i-th unit, first, the first equation is estimated for each unit in the panel, the constraint test is applied for the first k lags, and the bootstrap p-value is calculated. In the next step, the following test statistic is calculated using these p-values:

$$FTYP = -2 \sum_{i=1}^{N} \ln(\hat{p}_i) \quad (4)$$

Because of the possible cross-sectional effect, critical values/p values for this test statistic are obtained by bootstrap (Yilanci and Gorus, 2020).

After causality, for coefficient estimates, Two-Step GMM methods are used. Dynamic panel data models allow lagged values of dependent and independent variables to be added to the model as explanatory variables. In this context, a dynamic model was established by adding the lagged value of the dependent variable to the model as an independent variable. The GMM method developed by Arellano and Bond (1991) was used for model estimation. This method is often preferred when there is a linear functional relationship in panels with small T and large N (Roodman, 2009: 86). The autoregressive model without exogenous variables was defined by Arellano and Bond (1991) as follows:

$$y_{it} = \alpha y_{i(t-1)} + \eta_i + v_{it}, \quad |\alpha| < 1 \tag{5}$$

Here, a definition is made for the case where T is small and N is large. The model in which the explanatory variable is added is as follows:

$$y_{it} = \alpha y_{i(t-1)} + \beta' x_{it}^{*} + \eta_i + v_{it} = \delta' x_{it} + \eta_i + v_{it} \tag{6}$$

In order to obtain reliable results from the GMM estimation, some tests must be performed. Firstly, first-order and second-order autocorrelation should be checked. The null hypothesis for the autocorrelation test is that there is no autocorrelation. For the reliability of the results obtained, it is expected that there is a negative autocorrelation of the first order. However, there should be no second order autocorrelation. The Sargan (1958) test also tests over-identification constraints. The null hypothesis for the Sargan test indicates that there are over-identification constraints in the model. If the basic hypothesis cannot be rejected, it is decided that there are excessive over-identification constraints, that is, the instrumental variables are valid (Sargan, 1958).

4. Empirical Results

In this study, the effect of transportation on income inequalities was analyzed using panel fourier causality test and two-step GMM in 21 OECD countries period of 2004-2017, and panel fourier causality test results are presented in Table 3.

Table 3: Panel Fourier Test Results

	$H_0: LTransp \nrightarrow LGini$				
Country	Lag	Freqeuncy	Test Stat.	Prob.	Results
Austria	1	1	0.554	0.485	$LTransp \nrightarrow LGini$
Canada	2	1	0.661	0.740	$LTransp \nrightarrow LGini$
Czech Republic	2	1	0.587	0.765	$LTransp \nrightarrow LGini$
Denmark	2	1	0.913	0.663	$LTransp \nrightarrow LGini$
Finland	1	3	4.752*	0.0681	$LTransp \rightarrow LGini$
France	1	1	1.604	0.260	$LTransp \nrightarrow LGini$
Germany	1	1	11.851**	0.012	$LTransp \rightarrow LGini$
Hungary	2	1	2.516	0.397	$LTransp \nrightarrow LGini$
Iceland	1	2	0.942	0.370	$LTransp \nrightarrow LGini$
Italy	2	2	64.814***	0.009	$LTransp \rightarrow LGini$
Luxembourg	1	3	1.176	0.321	$LTransp \nrightarrow LGini$
Norway	2	1	0.185	0.892	$LTransp \nrightarrow LGini$
Slovak Republic	1	1	1.381	0.286	$LTransp \nrightarrow LGini$
Sweden	2	1	7.338	0.159	$LTransp \nrightarrow LGini$
United Kingdom	2	1	14.330*	0.068	$LTransp \rightarrow LGini$
United States	2	2	11.453*	0.098	$LTransp \rightarrow LGini$
Estonia	2	3	11.051	0.103	$LTransp \nrightarrow LGini$
Latvia	2	1	5.041	0.244	$LTransp \nrightarrow LGini$
Lithuania	2	2	3.809	0.289	$LTransp \nrightarrow LGini$
Moldova	2	1	13.028*	0.078	$LTransp \rightarrow LGini$
Romania	2	2	7.017	0.163	$LTransp \nrightarrow LGini$
Panel Fisher			70.571***	0.0037	$LTransp \rightarrow LGini$
Bootstrap cv (10%)			53.734		
Bootstrap cv (5%)			57.684		
Bootstrap cv (1%)			66.619		

10000 bootstraps were used to obtain critical values. ↛: no causality; →: there is causality.

The panel Fourier test results show that the basic hypothesis is rejected because prob. values are smaller than the critical values for panel. Therefore, a causal relationship was found between transport infrastructure investment and income inequality for panel. According to the results obtained on a country basis, there is a causal relationship from the transport infrastructure investment to income inequality in Finland, Germany, Italy, UK, USA and Moldova.

For coefficient estimation Two-Step GMM is used and analysis findings are presented in Table 4.

Table 4: Two-Step GMM Estimation Results

Variables	Two Step GMM
LGINI (-1)	0.4261***
LTRANSP	0.0046*
GROWTH	0.0001
LUNEMP	0.0099*
INF	0.0034***
LTAX	0.0632***
LTRADE	-0.0151
FDI	-0.0002***
AR (1) (p-value)	-3.7619 (0.0002)
AR (2) (p-value)	-1.2061 (0.2278)
Sargan test stat.	9.9794

, ** and * indicates statistical significance at the 10%, 5% and 1% levels.*

According to Two-Step GMM estimation results, transport infrastructure investment, unemployment rate, inflation, tax revenue and foreign direct investment have statistically significant effects on income inequality. The lagged value of income inequality positively affects income inequality. Transport infrastructure investment has statistically significant effect on income inequality positively at the level of 10%. A 1% increase in transport infrastructure investment (inland total, % of GDP) increases income inequality by 0.004%. The unemployment rate indicates a statistically significant and positive effect on income inequality at the 10% significance level. A 1% increase in the unemployment rate increases income inequality by 0.009%. The inflation rate indicates a statistically significant and positive effect on income inequality at the 1% significance level. Under the assumption of ceteris paribus, a one-unit increase in inflation rate increases inequality by 0.34 % on average. The share of tax revenue in GDP indicates a statistically significant and positive effect on income inequality at the 1% significance level. Under the assumption of ceteris paribus, a 1% increase in the share of tax revenue in GDP increases inequality by 0.063% on average. Foreign direct investment net inflows of GDP have a statistically significant effect on income inequality at the level of 1%. A one-unit increase in FDI decreases income inequality by 0.02%. Growth and trade, on the other hand, do not have a statistically significant effect on income inequality.

Since the prob value obtained for the first-order autocorrelation is smaller than the 1% significance level, the basic hypothesis can rejected. Therefore, there is first-degree negative autocorrelation. Since the prob value of the second-order autocorrelation (AR (2)) is greater than the 1%, 5%, and

10% significance levels, the basic hypothesis cannot be rejected. Therefore, there is no second order autocorrelation. The absence of second-order autocorrelation also indicates that the estimation results are efficient. Since the prob. value calculated for the Sargan test statistic is smaller than from table value. Therefore the null hypothesis cannot be rejected. So the instrument variables are valid.

5. Conclusion

Transportation is one of the subjects of interdisciplinary discussion due to its multifaceted effects on societies. The transportation sector, which has a substantial impact on the foreign trade volume of countries through freight transportation, also provides companies with an essential competitive power in the international market. Transport, which has an impact on sectoral growth and regional growth, is one of the driving forces of social welfare and economic development. In particular, passenger transportation provides access to poor households living in rural areas to current job opportunities, primarily clustered in industrial centers and cities. This, on the one hand, reduces the pressure of unemployment. On the other hand, it can reduce the level of poverty.

The fact that transportation directly affects essential indicators of socio-economic life such as growth, welfare, poverty, and unemployment causes it to be a determinant on essential components of social unrest such as regional imbalance and income distribution imbalance. In this context, transportation is one of the essential parameters in explaining income inequality both directly and through transmission channels. A developed transportation sector affects the total costs and contributes positively to the purchasing power of poor households through the price channel. In addition, it positively affects the employment of the poor by providing access to the regions where job opportunities are clustered for households living in rural areas. The development of the sector can also reduce the unemployment of the low-skilled labor force.

On the other hand, a developed transportation system also provides a cost advantage to the employer and positively affects the wealth of high-income households. Significantly, the high-profit margins of the companies operating on a global scale due to logistics can increase income inequality. Ultimately, transportation is a sector that can affect the income level of all segments of society. At this point, how it will affect income inequality is directly related to its effect on which income level. In this context, it can be said that the relationship between transportation and income distribution is fed through multiple channels.

When the literature discussing the transportation sector and income inequality is examined, it is seen that there are factors that both increase and decrease income inequality. In addition, it can be said that the studies are mainly focused on the Chinese economy. However, the literature on high-income countries is very limited. It is expected that transportation reduces income inequality with the opportunities it provides to the poorest segment of society in low-income countries or low-income regions. However, is this also true in high-income countries? What will be the trend, especially in countries where global companies are concentrated? Because developments in transportation provide high benefits to global companies or high-income individuals and the poor in these countries. Therefore, influencing these two different segments may cause income inequality to be meaningless. The findings obtained in this study support this hypothesis.

In this study, the effect of transportation on income inequality was investigated from 2004-2017 in 21 OECD countries. For transportation, transport infrastructure investment, which is frequently preferred in the literature, is used. In the study, the causality relationship for countries was firstly tested with the Fourier Causality Test. Then, Two-Step GMM was used for coefficient estimation. According to the Fourier Causality Test, causal relationship was found between transportation and income inequality for panel. On the other hand, Two-Step GMM findings indicate that transportation is statistically significant on income inequality. Accordingly, transportation infrastructure increase income inequality in the 21 OECD countries. These findings indicate that transportation provides more benefits to individuals with higher income levels in the countries. Because the countries in the study are mostly high-income and upper-middle-income countries where global companies are clustered. On the other hand, the findings support the work of Lin (2019) and Mendoza and Migues (2017).

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Appendix

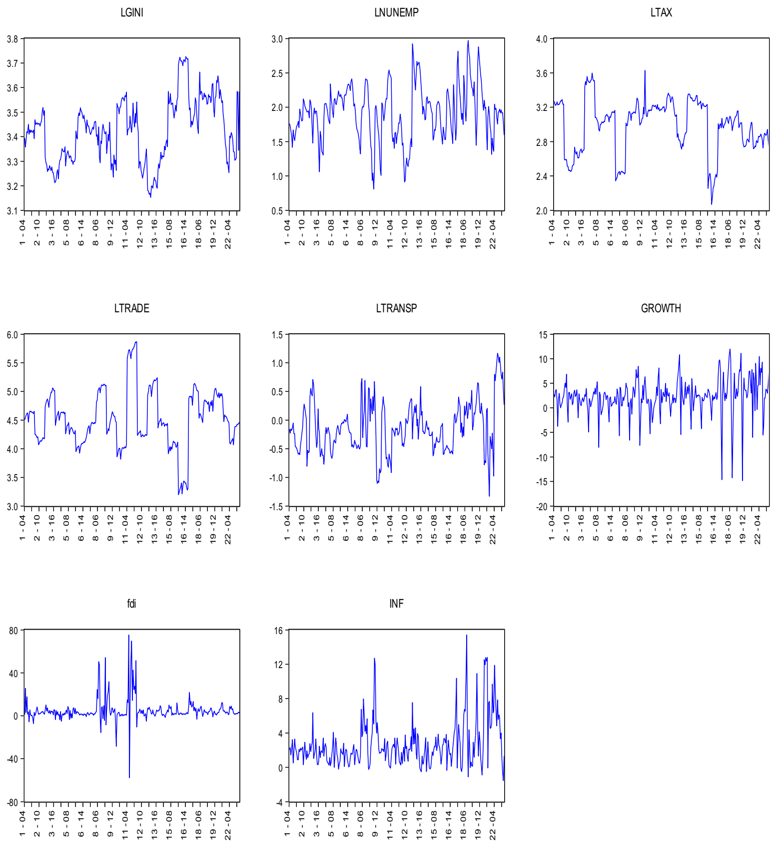
Table A1: OECD Countries in the Study

No	Countries	No	Countries
1	Avusturia	13	Lithuania
2	Canada	14	Luxembourg
3	Czech Republic	15	Moldova
4	Denmark	16	Norway
5	Estonia	17	Romania
6	Finland	18	Slovak Republic
7	France	19	Sweden
8	Germany	20	United Kingdom
9	Hungary	21	United States
10	Iceland		
11	Italy		
12	Latvia		

Table A2: Correlation Matrix

	LGINI	LTRANSP	GROWTH	INF	LUNEMP	LTRADE	LTAX	FDI
LGINI	1	0,1311	-0,2715	-0,3392	-0,0743	0,0099	0,0125	0,0556
LTRANS	0,1311	1	-0,1809	0,0879	0,1401	-0,1584	-0,1025	-0,1105
GROWTH	-0,2715	-0,1809	1	0,2416	-0,0257	-0,0212	0,0827	-0,0553
INF	-0,3392	0,0879	0,2416	1	0,2034	0,1353	0,3209	0,0914
LUNEMP	-0,0743	0,1401	-0,0257	0,2034	1	0,0428	0,0868	0,1620
LTRADE	0,0099	-0,1584	-0,0212	0,1353	0,0428	1	0,1063	0,1968
LTAX	0,0125	-0,1025	0,0827	0,3209	0,0868	0,1063	1	0,1176
FDI	0,0556	-0,1105	-0,0553	0,0914	0,1620	0,1968	0,1176	1

Table A3: Graphs of Series



PART IV

INTERNATIONAL TRADE AND FINANCE

13

Can Biomass be an Eco-Friendly Energy Source? Fresh Evidence from Causality Methods

Abdulmecit Yıldırım (Muş Alparslan University)
ORCID: 0000-0002-6228-6601
a.yildirim@alparslan.edu.tr

Sinan Erdoğan (Hatay Mustafa Kemal University)
ORCID: 0000-0003-3491-8234
phderdogan@gmail.com

İlyas Okumuş (Kahramanmaraş Sütçü İmam University)
ORCID: 0000-0003-2225-4215
ilyas.okumus@hotmail.com

Abstract

Environmental concerns have been rising since the second half of the 20th century, and many alternative policy instruments have been proposed by scientists and researchers to halt environmental degradation. Within this scope, the promotion of biomass consumption is considered as a clean and eco-friendly fuel technology in international treaties such as Kyoto Treaty. The primary purpose of this paper is to examine whether there is a causal connection among biomass consumption, ecological footprint, and its components in Turkey for the period from 2000 to 2016 by employing various causality approaches. Empirical findings show a causal effect running from biomass consumption to cropland, whereas there is no causal effect running from biomass consumption to other environmental indicators. Therefore, biomass consumption might be a clean energy technology for the Turkish economy and may help to reduce the environmental harm of energy consumption.

Keywords: Biomass, Ecological Footprint, Toda-Yamamoto, Causality, Fourier

JEL Codes: Q01, Q56, O13

1. Introduction

Nonrenewable energy resources such as oil, coal, and natural gas have been the primary source of energy for both industry and home consumption. Despite the discovery and usage of alternative energy sources, fossil fuels continue to account for a considerable portion of many countries' overall energy consumption. The fact that countries meet most of their energy needs from fossil fuels has some undesirable consequences. Countries with inadequate nonrenewable energy sources, i.e., those that heavily import oil and natural gas, are more vulnerable to price fluctuations. Uncertainties in the costs of energy, which is an essential input in the production process, can disturb a country's macroeconomic balance and convert the economy into a fragile structure (Akinsola and Odhiambo 2020; Timilsina 2015). Furthermore, it is well understood that fossil fuels contribute to major health issues, global warming, and climate change through increasing greenhouse gas emissions in the atmosphere.

One of the most important pillars of sustainable development is environmental quality. One of the factors affecting environmental degradation is undoubtedly the use of fossil fuels. The way to prevent this is to increase the share of renewable energy sources in total energy consumption (Bhattacharya et al. 2016). For this reason, countries shape their policies in the context of environment-friendly energy resources and sustainable development. Since the energy sector is the basic element of sustainable development, countries focus on policies that promote the broad use of clean energy resources while also boosting their efficiency. The rise of carbon dioxide in the atmosphere caused by the consumption of fossil fuels may result in unfavorable outcomes such as reduced quality of life and global warming. These unfavorable conditions have a considerable impact on environmental quality. Considering the relationship between income and environmental degradation, low-income countries and individuals are much more affected by this negative situation. Because income can positively affect environmental quality after a certain threshold level. In other words, according to the EKC hypothesis positive effect of income on environmental quality occurs when the income level of the country reaches the mean level in industrialized economies. (Ahmed, Uddin, and Sohag 2016; Bilgili, Koçak, and Bulut 2016; Danish, Ulucak, and Khan 2020; Ozturk and Acaravci 2010; Ozturk and Acaravci 2013; Sarkodie et al. 2019; Shahbaz, Balsalobre, and Shahzad 2019). Alternative energy sources that may be used in place of fossil fuels can help to decrease the harmful impact of fossil fuels on the environment. In other words, instead of fossil fuels such as oil, natural gas, and coal, which are the most important causes of carbon emissions, renewable energy sources like biomass, solar, wind, geothermal energy sources should be substituted.

As countries become aware of the serious effects of climate change, they act more willingly in the implementation and dissemination of international decisions taken to combat the climate crisis. International agreements (such as the Kyoto, and Paris agreement) with which countries have committed to comply with reducing carbon emissions, technological developments, the subsidies given by countries to renewable energy sources, the demand of individuals and societies for a clean and reliable environment have allowed the rapid growth and diversification of renewable energy sources. In the GSR (Global Status Report) 2019, it is stated that biomass makes the biggest contribution to the global energy supply with a rate of 12.4% among renewable energy sources (REN21 2019:71). Biomass energy has certain advantages that distinguish it from other renewable energy sources. First, biomass energy has widespread use. It can be used in areas such as heating, electricity generation, industry, and transportation. Second, it is the only form of renewable energy source that can be converted to liquid fuel. This feature allows it to be substituted for oil in the short term. Third, its production is relatively easy, and its raw materials can be found in abundance. Fourth, having a closed carbon cycle makes biomass an environment-friendly, carbon-neutral energy source (Sikka et al. 2013). Finally, the production of the raw material required in the process of producing biomass energy can contribute to rural development by creating new job opportunities (Bildirici and Özaksoy 2018).

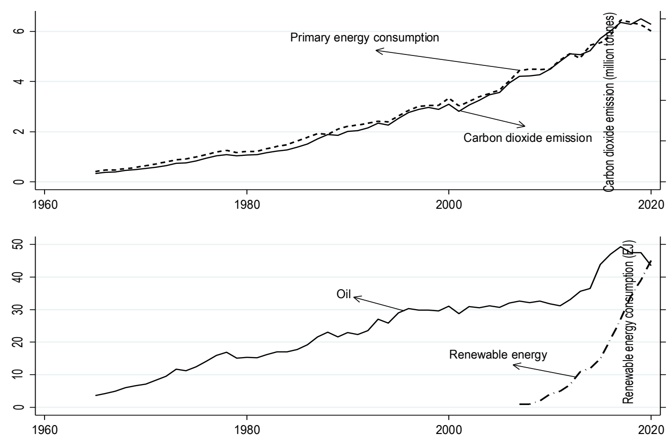
Biomass includes solid, liquid, and gaseous fuels obtained from agricultural and forest products and by-products resulting from the processing of these products, including vegetable oil wastes, agricultural harvest residues, as well as organic wastes. Although biomass is defined as a carbon-neutral energy source (Solarin and Bello 2019), in order for biomass energy to be a solution to current problems, suitable planting areas, suitable and efficient bioenergy plant species and effective management practices should be determined (Wu et al. 2018). Otherwise, biomass energy production and consumption may result in harmful consequences for the environment and human health. In lack of appropriate planning, the land and plant products that will be utilized in biomass energy production may endanger food safety. Due to the multidimensional nature of biomass energy, which is closely related to the environment, and the positive and negative effects it may have on the environment, it is important to comprehensively examine the effects of biomass on the environment.

Based on these reasons, this study aims to analyze the causal relationship between biomass and ecological footprint as considered a comprehensive indicator of environmental quality. Ecological footprint, which is one of the total indicators of environmental degradation, is monitored by the sum of six different surface area components that show productivity: cropland, grazing area, fishing area, area for carbon demand, built-up area, and forest demand areas. Developed by Wackernagel and Rees (1996), the ecological footprint is a comprehensive and multidimensional environmental quality indicator that mainly compares the environmental degradation caused by human consumption with the regenerative capacity of the biosphere. Therefore, it is tried to explain the causal relationship between biomass consumption and total ecological footprint and its six sub-components for Turkey.

When we examine Turkey's energy consumption profile, we can see that primary energy consumption has increased rapidly. As shown in the top panel of Figure 1, primary energy consumption has risen more than sixfold from 1960 to 2020. One of the possible explanations for this rapid primary energy consumption is that Turkey is a developing country with a high population growth rate. CO2 emission, a key indicator of climate change and environmental degradation, follows a similar path to energy consumption (See the top panel of Figure 1). Turkey is committed to adhering to international conventions to reduce carbon emissions in the context of combating climate change. Given that Turkey is a net oil-importing country, diversification of renewable energy sources is critical in sustainable development policies. Figure 1 bottom panel shows Turkey's oil and renewable energy consumption between 1965 and 2020. Although there has been a decrease in oil consumption in recent years, it has generally increased between 1965 and 2020. Before 2007, the share of renewable energy sources was relatively low. Renewable energy sources, on the other hand, increased significantly after 2007. Benli et al. (2019) state that oil price increases have adverse effects on the Turkish economy in the long run. Turkey, which has insufficient fossil fuel reserves and wishes to combat global warming and climate change, should increase the share of renewable energy resources in total energy resources.

The contributions of the study are as follows: First, Since Turkey is an oil and natural gas importing country, Turkey pay attention to renewable energy sources and tries to increase the share of renewable energy sources in total energy consumption. Second, Turkey's ecological footprint is greater than its biocapacity (Bulut 2020). In addition, Turkey is willing to implement the international decisions taken on the fight against climate change. For this reason, identifying the determinants of the ecological footprint and implementing suitable policies that will reduce the ecological footprint play a crucial role for Turkey. Third, studies examining the relationship between biomass energy and ecological footprint in Turkey are few and have used CO_2 as an indicator of environmental degradation. In addition, to the best of our knowledge, there are no studies on Turkey that consider the sub-components of ecological footprint. Considering the aforementioned motives and objectives, the goal of this study is to investigate the relationship between biomass energy consumption and ecological footprint and its six sub-components in Turkey using annual data over the period 2000-2016.

Figure 6: Primary energy consumption vs. carbon dioxide emission in Turkey



Source: Plots are created by the authors using data from the bp Statistical Review of World Energy 2021.

After an overview of the energy-environment nexus presented in the Introduction, previous studies are organized and summarized in the Literature review section. The data set, empirical methodology, and results are provided in Data, Methodology & Empirical Results section. Finally, discussion and policy recommendations are presented in the Conclusion section.

2. Literature Review

There are extensive research studies that investigate the nexus between energy and environment. In most of the studies, CO_2 is used as an indicator of environmental degradation (Adewuyi and Awodumi 2017; Ahmed et al. 2016; Baležentis et al. 2019; Bilgili 2012; Bilgili, Öztürk, et al. 2016; Bilgili, Koçak, et al. 2016; Danish and Ulucak 2020; Katircioglu 2015; Sarkodie et al. 2019; Shah et al. 2020; Shahbaz et al. 2017; Shahbaz, Balsalobre, et al. 2019; Shahbaz, Balsalobre-Lorente, and Sinha 2019; Solarin et al. 2018; Zafar et al. 2021). In addition, some researchers have examined the relationship between energy and environment based on the ecological footprint, which is a more comprehensive indicator of environmental degradation than CO_2 emission (Altıntaş and Kassouri 2020; Danish et al. 2020; Hadj 2021; Mehmood 2021; Wang et al. 2020).

When investigating the energy-environment nexus, the type of energy utilized also varies. While some studies focused on renewable and nonrenewable energy sources at the aggregate level (Destek and Sinha 2020);), others concentrated on the sub-components of these two major energy groups (Bilgili, Öztürk, et al. 2016; Solarin and Bello 2019; Wang et al. 2020).

Studies examining the relationship between energy and the environment have generally focused on the axis of energy consumption, GDP, and CO_2 emissions. Pioneering studies used CO_2 emission as an indicator of environmental deterioration and investigated the link between aggregate energy consumption and CO_2 emissions. Subsequent literature has divided energy consumption into two subcategories and focused on the relationship between renewable and nonrenewable energy sources and the environment. Studies based on the ecological footprint, which includes other dimensions of environmental degradation, are relatively few. Research suggesting that CO_2 emissions are a narrow indicator of environmental degradation and therefore using the ecological footprint, which is a more comprehensive indicator, has enriched the relevant literature. Furthermore, studies that divide renewable energy sources into their sub-components and investigate the effect of each component independently have been conducted. However, the environmental implications of biomass energy consumption, which accounts for a significant portion of renewable energy sources, have not been well investigated.

The results of the studies examining the environmental impact of biomass energy consumption are contradictory. Some studies claim that biomass energy is harmful to the environment, while others argue that it improves environmental quality. The country group, period, and econometric model used can be suggested as the primary reason for these different results. In addition, the use of biomass with traditional methods in developing countries can have severe effects on the environment and human health (Karekezi, 2004). Therefore, biomass energy technologies need to be modernized in terms of cost, efficiency, and emissions. According to (Shahbaz, Balsalobre, et al. 2019), reducing carbon emission is dependent on the efficiency of production technologies and the amount of fossil fuel utilized to produce biomass energy.

In recent years, debates on the energy-environment nexus have focused on the environmental implications of biomass energy. However, the majority of studies solely look at environmental degradation in terms of CO_2 emissions caused by energy consumption yet neglect other factors. Thus, in this study, we utilized the ecological footprint as a measure of environmental degradation to investigate the relationship between biomass energy consumption and ecological footprint. This paper uses ecological footprint as an indicator of environmental degradation since it includes cropland, built-up land, grazing land, and forests, fishing grounds as well as carbon footprint (Eren and Alper 2021). Table 1 summarizes the literature on biomass energy consumption and environmental degradation in the context of ecological footprint and CO_2 emission.

Table 19: Summary of previous studies on biomass energy consumption, ecological footprint, CO2

Authors	Sample	Period	Methodology	Findings
Destek et al. (2021)	Brazil, China, Germany, India, the US	1970-2016	CUP-FM, CUP-BC	BE raises EF
Mehmood (2021)	SAARC	1990-2016	FMOLS, DOLS	BE raises EF
Hadj (2021)	Saudi Arabia	1984-2017	NARDL	BE^+ reduces EF
Magazzino et al. (2021)	Germany	1990-2018	The quantum model	BE reduces CO_2
Shahbaz, Balsalobre-Lorente, et al. (2019)	MENA countries	1990-2015	GMM, Pairwise Dumitrescu-Hurlin panel causality	BE reduces CO_2
Ahmed et al. (2016)	24 European countries	1980-2010	MG, PMG, DFE	BE insignificant
Katircioglu (2015)	Turkey	1980-2010	ARDL	BE reduces CO_2
Sarkodie et al. (2019)	Australia	1970-2017	ARDL	BE reduces CO_2
Shah et al. (2020)	38 Asian countries	1990-2017	CCEMG, PVAR	BE raises CO_2
Bilgili et al. (2017)	US	1982-2011	Hatemi-J asymmetric causality	BE reduces CO_2
Zafar et al. (2021)	APEC countries	1990-2018	Panel quantile regression, Dumitrescu-Hurlin panel causality	BE raises CO_2
Shahbaz, Balsalobre, et al. (2019)	G-7 countries	1980-2014	GMM	BE raises CO_2
Baležentis et al. (2019)	EU countries	1995-2015	FMOLS, DOLS	BE reduces CO_2
Bilgili (2012)	US	1990M1-2011M9	Cointegration	BE reduces CO_2
Danish and Ulucak (2020)	China	1982-2017	NARDL	BE reduces CO_2
Danish and Wang (2019)	BRICS	1992-2013	GMM	BE reduces CO_2
Shahbaz et al. (2017)	US	1960-2016	ARDL	BE reduces CO_2

Notes: BE and CO2 stand for biomass energy consumption and carbon dioxide emission, respectively. BE+ stands for positive shocks of BE.

As shown in table 1, prior empirical research has reached contradictory results regarding the association between biomass electricity consumption and environmental degradation in terms of ecological footprint and CO_2 emissions. Considering the methodology, sample, and period utilized, previous studies have highlighted both positive and negative effects of biomass energy consumption on environmental quality. When CO_2 is used as an indicator of environmental degradation, some studies concluded that biomass energy consumption is environment-friendly because it reduces CO_2 emissions (Baležentis et al. 2019; Bilgili et al. 2017b; Danish and Ulucak 2020; Danish et al. 2020; Danish and Wang 2019; Dogan and Inglesi-Lotz 2017; Katircioglu 2015; Magazzino et al. 2021; Sarkodie et al. 2019; Shahbaz, Balsalobre-Lorente, et al. 2019). Some others concluded that biomass energy consumption is harmful to the environment because it increases CO_2 emissions (Shah et al. 2020; Shahbaz, Balsalobre, et al. 2019; Zafar et al. 2021).

As previously stated, only a few empirical research (Destek et al. 2021; Hadj 2021; Mehmood 2021) investigated the relationship between biomass energy and ecological footprint. Furthermore, these studies concentrated on the effects of biomass energy consumption on aggregate ecological footprint and neglected the sub-components of ecological footprint. The recent studies could be summarized as follows: Destek et al. 2021 analyzed the relationship between biomass energy consumption and ecological footprint for the top five biomass energy-consuming countries for the 1970-2016 period. Continuously updated fully modified (CUP-FM), and continuously updated bias-corrected (CUP-BC) panel estimation techniques are utilized to investigate biomass energy-environment nexus. The results indicate that biomass energy consumption increases ecological footprint. Mehmood (2021) examined the impacts of biomass energy consumption on ecological footprint by applying FMOLS and DOLS for SAARC countries for the 1990-2016 period. The results show that biomass energy consumption increases the ecological footprint in SAARC countries. The causality analysis confirms unidirectional causality running from biomass energy consumption to ecological footprint. Hadj (2021) studied the relationship between biomass energy consumption and ecological footprint for Saudi Arabia over the period of 1984–2017 using the NARDL methodology. He found that ecological footprint was sensitive only to positive changes in biomass energy consumption. When these studies are reviewed, it is seen that there is no study examining the relationship between biomass energy consumption and the six sub-components of the ecological footprint. In order to fill this gap in the literature, this study try to investigate the causal link between biomass energy consumption and the six sub-components of the ecological footprint in Turkey.

3. Data, Methodology & Empirical Results

Although carbon emission is considered as the main responsible for climate change and global warming, it is frequently criticized by researchers because of being a reductive indicator of environmental degradation. In this regard, the ecological footprint developed by Wackernagel and Rees

(1998) is proposed by researchers as a comprehensive indicator of environmental pollution (Solarin, 2019). The ecological footprint measures the biologically productive land and water area required to produce the natural habitat either consumed or destructed by people and eliminate the waste created by economic activities. The ecological footprint can be divided into six sub-components referred as cropland footprint (required area for food), grazing land footprint (required area for farming), forest footprint (required forest area paper and wood production), carbon footprint (required ocean and forest area to absorb CO_2 emissions), fishing grounds footprint (required area for seafood production), and built-up land footprint (required area for residential, transportation, industrial structures, and power plants). It can be said that the ecological footprint considers various dimensions of the environmental consequences of anthropogenic activities (Erdogan & Okumus, 2021; Ulucak & Lin, 2017). Based on these theoretical explanations, to investigate the causal nexus between biomass consumption per capita (million Kilowatt, logarithmic) and ecological footprint per capita and its sub-components. Due to data limitations on biomass consumption data, we investigated the causality nexus between biomass consumption and ecological footprint per capita and its sub-components in Turkey for the period from 2000 to 2016. We obtained biomass consumption, ecological footprint, and population data from U.S. Energy Information Administration (2019), The Global Footprint Network (2019), and World Bank (2020), respectively. The descriptive statistics of the variables are reported in Table 2. The maximum statistics of the ecological footprint was 1.22, while its minimum is 0.46. The maximum statistics of the biomass consumption is -19.203, while its minimum is -20.291. Moreover, the maximum statistics of ecological footprint's sub-component belongs to carbon footprint, while the minimum belongs to fishing grounds. The Jarque-Bera test results show that employed data are normally distributed.

Table 2: Descriptive Statistics

Variable	Mean	Median	Max.	Min.	Std. Dev.	Jarque-Bera	Prob. for Jarque-Bera
Biomass Consumption	-20.136	-20.221	-19.203	-20.491	0.387	3.625	0.163
Built-Up Land	-3.365	-3.358	-3.283	-3.493	0.054	2.305	0.316
Carbon Footprint	0.518	0.564	0.702	0.093	0.170	2.667	0.264
Cropland Footprint	-0.108	-0.120	-0.008	-0.198	0.050	0.197	0.906
Fishing Grounds	-3.255	-3.233	-2.688	-3.543	0.213	2.878	0.237
Forest Products	-1.273	-1.213	-1.091	-1.655	0.179	2.289	0.318
Grazing Land	-2.142	-2.162	-1.909	-2.306	0.114	0.642	0.726
Ecological Footprint	1.119	1.138	1.222	0.846	0.100	5.235	0.073

We started the empirical estimation by utilizing the causality approach developed by Toda and Yamamoto (1995). The Toda-Yamamoto approach could be conducted without determining the integration level and existence of cointegration in model. Therefore, stationarity/unit root tests and cointegration as a preliminary analysis are not needed. Toda-Yamamoto causality test adopts the idea of following the Vector Autoregressive (VAR) model (Erdogan et a. 2021):

$$y_t = \alpha + \beta_1 y_{t-1} + \ldots + \beta_{p+d} y_{t-(p+d)} + \varepsilon_{1t} \tag{1}$$

Where y_t is consist of *K* endogenous variables, *p* denotes the lag length, *d* denotes variables' max. level of integration, α is the constant, β are coefficient matrices, and ε_{1t} is the residual. The Toda-Yamamoto causality methods tests the null hypothesis of Granger non-causality $(H_0 : \beta_1 = ... = \beta_p = 0)$, with obtained test statistics based on Wald statistic and asymptotic χ^2 distribution with *p* degrees of freedom (Nazlioglu, Gormus, & Soytas, 2016; Toda & Yamamoto, 1995). However, Hacker and Hatemi-J (2006) emphasized that size of the Toda-Yamamoto method is relatively weak in the case of asymptotic distribution (χ^2). Furthermore, conduction of the leveraged bootstrap distribution can provide relatively satisfying estimations on reducing size distortions. Thus, they suggest utilizing bootstrap-augmented Toda-Yamamoto (Hacker and Hatemi-J 2006) causality method.

The economic variables are generally subject to structural shifts; therefore, ignoring such shifts can cause to biased estimations (Erdogan, Akalin, & Oypan, 2020). In addition, failure to model structural shifts in data could lead to false rejection of the null hypothesis of of non-causality (Enders & Jones, 2016). Therefore, Nazlioglu et al. (2016) modified the standard Toda-Yamamoto approach by including the Fourier term that controls for structural changes. The Fourier Toda-Yamamoto method does not entail any preliminary analysis for determining the stationarity level and existence of cointegration. The DGP of the Fourier Toda-Yamamoto method could be shown as follows (Nazlioglu et al., 2016):

$$y_t = \alpha(t) + \beta_1 y_{t-1} + \ldots + B_{p+d} y_{t-(p+d)} + \varepsilon_{2t} \tag{2}$$

Where $\alpha(t)$ is a function of time and denotes the structural change on the dependent variable. Eq. 2 could be modified as below by utilizing Fourier functions:

$$\alpha_t = \alpha_0 + \sum\nolimits_{k=1}^{n} \gamma_{1k} \sin(2\pi kt/T) + \sum\nolimits_{k=1}^{n} \gamma_{2k} \cos(2\pi kt/T) \tag{3}$$

Where *n* denotes the number of frequencies. Eq. 3 could be extended as below:

$$\alpha_t = \alpha_0 + \gamma_1 \sin(2\pi kt/T) + \gamma_2 \cos(2\pi kt/T) \tag{4}$$

Where *k* denotes number of Fourier frequency. The general test strategy of the Fourier Toda-Yamamoto could be denoted by utilizing Eq. 2 and 4 as:

$$y_t = \alpha_0 + \gamma_1 \sin(2\pi kt/T) + \gamma_2 \cos(2\pi kt/T) + \beta_1 y_{t-1} + \ldots + B_{p+d} y_{t-(p+d)} + \varepsilon_{2t} \tag{5}$$

Nazlioglu et al. (2016) utilize the null hypothesis of non-Granger causality and use the bootstrap strategy to estimate more powerful test statistics that satisfy small sample properties. Such a method gives robust estimations in the presence of unit root and cointegration.

The standard Toda-Yamamoto causality test results are shown in Table 3. The findings show that the null hypothesis of non-Granger causality from biomass consumption to carbon footprint, fishing ground, grazing lands, forest products, cropland, built-up lands, and total ecological footprint per capita cannot be rejected by considering asymptotic and bootstrap probability values. Therefore, there are causal nexus exist between biomass consumption, ecological footprint, and components. Moreover, Fourier Toda-Yamamoto Causality Test with Single Frequency test results reveal that null hypothesis of non-Granger causality from cannot be rejected biomass consumption to carbon footprint, fishing ground, forest products, built-up lands, and total ecological footprint per capita cannot be rejected by considering asymptotic and bootstrap probability values. On the contrary, the Fourier Toda-Yamamoto Causality Test with Single Frequency test results reveal that the null hypothesis of non-Granger causality is rejected biomass consumption to cropland by considering both asymptotic and bootstrap probability values. Therefore, a causal effect runs from biomass consumption per capita to cropland.

On the one hand, the Fourier Toda-Yamamoto Causality Test with Single Frequency test results reveal that the null hypothesis of non-Granger causality from is rejected biomass consumption to grazing land at 5% significance by considering asymptotic probability value. On the other hand, the null hypothesis of non-Granger causality cannot be rejected biomass consumption to grazing land by considering bootstrap probability value. Nazlioglu et al. (2016) report bootstrap procedure allows us to obtain more powerful test statistics that satisfy small sample properties. Therefore, it could be more rational to consider bootstrap probability value. It can be said that there is no causal effect running from biomass consumption per capita to grazing land in the Turkish economy. Moreover, bootstrap probability values are considered on hypothesis test is considered on hypothesis tests of Fourier Toda-Yamamoto Test with Cumulative Frequency

Table 3: Causality Tests Results

Hypothesis	Test Stat.	Asymptotic Prob.	Bootstrap Prob	k	ρ
Toda-Yamamoto & Bootstrap-Augmented Toda-Yamamoto Tests					
BIO ≠> CARBON	0.090	0.956	0.955	-	2
BIO ≠> FISHING GROUNDS	2.233	0.135	0.154	-	1
BIO ≠> GRAZING LANDS	0.124	0.725	0.728	-	1
BIO ≠> FOREST PRODUCTS	0.525	0.769	0.773	-	2
BIO ≠> CROPLAND	3.530	0.171	0.236	-	2
BIO ≠> BUILT – UP LAND	0.091	0.763	0.764	-	1
BIO ≠> ECOLOGICAL FOOTPRINT	0.185	0.911	0.907	-	2
Fourier Toda-Yamamoto Test with Single Frequency					
Hypothesis	**Test Stat.**	**Asymptotic Prob.**	**Bootstrap Prob**	**k**	ρ
BIO ≠> CARBON	1.048	0.592	0.628	3	2
BIO ≠> FISHING GROUNDS	0.629	0.428	0.437	3	1
BIO ≠> GRAZING LANDS	6.135	0.047	0.145	3	2
BIO ≠> FOREST PRODUCTS	0.374	0.829	0.820	1	2
BIO ≠> CROPLAND	37.685	0.000	0.006	1	2
BIO ≠> BUILT – UP LAND	1.251	0.263	0.315	2	1
BIO ≠> ECOLOGICAL FOOTPRINT	1.389	0.499	0.541	3	2
Hypothesis	**Test Stat.**	**Asymptotic Prob.**	**Bootstrap Prob**	**k**	ρ
BIO ≠> CARBON	78.939	0.000	0.122	3	2
BIO ≠> FISHING GROUNDS	507.489	0.000	0.046	3	2
BIO ≠> GRAZING LANDS	13.754	0.001	0.247	3	2
BIO ≠> FOREST PRODUCTS	7.696	0.021	0.357	3	2
BIO ≠> CROPLAND	164.384	0.000	0.072	3	2
BIO ≠> BUILT – UP LAND	44.287	0.000	0.154	3	2
BIO ≠> ECOLOGICAL FOOTPRINT	1.480	0.477	0.626	3	2

Note: ρ : optimal lag, k: number of Fourier frequency. We determined optimal lag lengths by utilizing the SIC. We estimated bootstrap critical values by conducting 1000 bootstrap replications.

The Fourier Toda-Yamamoto Causality Test with Cumulative Frequency test results shows that null hypothesis of non-Granger causality from biomass consumption to carbon footprint, fishing grounds, grazing lands, cropland, and built-up land is rejected, whereas cannot be rejected for forest product and ecological footprint per capita at least 10% significance level by considering asymptotic probability values. Moreover, the null hypothesis of non-Granger causality from biomass consumption to carbon footprint, grazing lands, forest products, built-up land, the ecological footprint cannot be rejected, whereas it can be rejected for fishing grounds and cropland at least 10% significance level. By considering bootstrap probability values, it can be said that there is a causal effect running biomass consumption to fishing grounds and cropland.

The summary of the causality test results is shown in Table 4. It can be said that no causal effects are running from biomass consumption to carbon footprint, grazing lands, forest products, built-up land, and ecological footprint. Moreover, Toda-Yamamoto causality test and Fourier Toda-Yamamoto Causality Test with Single Frequency test results show that there is no causal effect running from biomass consumption per capita to fishing grounds, whereas Fourier Toda-Yamamoto Causality Test with cumulative Frequency test results show that there is causal effect running from biomass consumption per capita to fishing grounds. It can be inferred that there is no causal effect running from biomass consumption per capita to fishing grounds by considering the majority of the test results. Last, the Toda-Yamamoto causality test result shows that there is no causal effect running from biomass consumption per capita to cropland. In contrast, Fourier Toda-Yamamoto Causality Test with Single Frequency and Fourier Toda-Yamamoto Causality Test with Cumulative Frequency test results show that there is a causal effect running from biomass consumption per capita to cropland. It can be inferred that there is a causal effect running from biomass consumption per capita to cropland by considering the majority of the test results.

Table 4: Summary of the Causality Test Results

Hypothesis	TY	FTYSF	FTYCF
BIO ≠> CARBON	X	X	X
BIO ≠> FISHING GROUNDS	X	X	
BIO ≠> GRAZING LANDS	X	X	X
BIO ≠> FOREST PRODUCTS	X	X	X
BIO ≠> CROPLAND	X		
BIO ≠> BUILT – UP LAND	X	X	X
BIO ≠> ECOLOGICAL FOOTPRINT	X	X	X

Notes: TY.: Toda-Yamamoto Test, FTYSF: Fourier Toda-Yamamoto Test with Single Frequency, FTYCF: Fourier Toda-Yamamoto Test with Cumulative Frequency, X denotes that null hypothesis of non-Granger causality cannot be rejected at least 10% significance level.

4. Conclusion

The Industrial Revolution led to an unprecedented increase in production. This inevitably caused to increase in resource use, and countries began to use more natural resources than their regenerative capacity. Therefore, the environmental burden of anthropogenic activities has been increased day by day. In this regard, environmental concerns have risen, and this led to the search for clean production and consumption technologies. Biomass is considered as a clean energy technology by researchers and the promotion of biomass consumption is suggested in international treaties such as Kyoto Treaty. In this regard, we aimed to investigate whether there is causal nexus between biomass consumption, ecological footprint, and its six sub-components in the Turkish economy. Empirical results reveal that there is a causal effect running from biomass consumption to cropland footprint. In contrast, there is no causal effect running from biomass to remainder.

On the one hand, the non-existence of causality running from biomass consumption to ecological footprint and its five components indicate that biomass consumption may be an alternative energy source. At least, it helps to halt the increase of the ecological burden of consumption and production activities and maintain environmental pollution at current levels in the Turkish economy. Therefore, policymakers could consider promoting biomass and its derivatives such as biodiesel and bioethanol. Considering the high level of indirect tax rates on traditional fossil fuels such as gasoline, diesel, and Autogas, the tax reduction on biomass production and consumption may help on creating a competitive environment for biomass prices. This may encourage to change consumption habits of the people in long term and promote them to shift to more eco-friendly technologies and give incentives to entrepreneurs to establish biomass production facilities. Considering that biomass energy consumption does not prevail in Turkish economy, therefore, another alternative way to promote biomass energy can be increasing supply of biomass energy. Hence, price level of this new and more clean fuel technology could diminish to reasonable levels and have competitive power against traditional fuels. Last, subsidizing biomass consumption within the scope of cost-sharing policy can help to reduce share of biomass prices in consumers' budget. This may increase the desirability of biomass consumption.

On the other hand, there is a causal effect running from biomass consumption to cropland footprint in Turkey. Therefore, policymakers should focus on unveiling the reasons causing that effect. Understanding the characteristics of these causal effects may help to shape effective policies for either halting the negative effect of biomass consumption or promoting positive externalities of this eco-friendly energy source. Last, future studies may consider to focus on investigating the magnitude of the effect of biomass consumption on the cropland footprint. This may help us to have deep insights on how they interact.

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14

Renewable Energy Consumption, CO2 Emissions and Economic Growth: A Comparative Analysis on G7 and BRICS-T Countries

Mürşit Recepoğlu (Gumushane University)
ORCID: 0000-0002-6861-2607
mursitrecepoglu@gumushane.edu.tr

Muharrem Akın Doğanay (Karadeniz Technical University)
ORCID:0000-0002-3985-2222
makindoganay@ktu.edu.tr

Abstract

The relationships between renewable energy consumption, CO2 emissions, and economic growth are examined in this study by Emirmahmutoğlu & Köse (2011) panel causality test. Two separate panel data sets of G7 and BRICS-T countries are created to analyze the relationships between the variables. Findings from the study show that the relationship between economic growth and environmental degradation is unidirectional in developing countries and bidirectional in developed countries. This situation reveals that the relationship between environmental degradation and economic growth is more robust in developed countries. On the other hand, it is concluded that the feedback hypothesis is valid in both developed and developing countries in terms of the relationship between economic growth and renewable energy consumption. However, it is determined that the conservation hypothesis is valid in some developing countries, and the growth hypothesis is correct in some developed countries. This finding reveals that renewable energy consumption on economic growth is more substantial in developed countries with relatively higher investments in renewable energy.

Keywords: Renewable Energy Consumption, Economic Growth, Pollution, Panel Causality Analysis

JEL Codes: O44, O11, Q43

1. Introduction

In recent years, impressive economic growth has occurred worldwide with the rapid industrialization and urbanization process. Parallel to this, energy consumption (EC) has increased considerably worldwide with the rapid population growth occurring globally. However, this has revealed environmental problems caused by carbon dioxide emissions (CO_2) from burning fossil fuels (Dong et al., 2018: 4). Although there are many types of environmental pollution, the most critical type of pollution is air pollution caused by greenhouse gas emissions. In order to overcome this situation, which has become a significant threat to the entire world ecosystem, countries have made various commitments with the Kyoto Protocol and the Paris Climate Agreement and set targets in this direction (Hasanov et al., 2021:1). In the Fifth Report of the Intergovernmental Panel on Climate Change in 2013, it is emphasized that global warming would significantly affect regional economic growth and social development. This report emphasizes that the leading cause of global warming and climate change is CO2 emissions based on fossil fuel consumption. (Chen et al., 2019:1).

On the other hand, the environmental damage caused by greenhouse gas emissions is not only a problem for developed countries (DC). Most of the CO2 emissions in the world belong to developing countries (DLC). This situation reveals that the problem is a global problem. However, in DLC with low carbon efficiency, the policy of reducing fossil fuel use and CO_2 emissions may have a negative impact on economic growth. Therefore, the negative impact of the policies to be implemented to reduce environmental damage on economic growth or the extent of this impact continues to be a fundamental issue for DLC (Ito, 2017:1).

The debates on this subject have contributed to the increase in the empirical literature on the relationship between environmental degradation and economic growth. In contrast, although international agreements have been made for renewable resources to reduce environmental pollution, the impact of these practices on economic growth is being discussed more and more every day. Therefore, the relationship between renewable energy consumption (REC), CO_2 and economic growth is of great importance for both DC and DLC.

Based on this motivation, in this study, causal relationships between REC, CO_2, and economic growth are analyzed comparatively for G7 consisting of DC and BRICS-T countries consisting of DLC. Thus, the causal relationships between the variables are analyzed in countries with different economic structures. After the introduction, the theoretical background on the relationship between "environmental degradation and economic growth " and "REC and economic growth" is mentioned in the study. Then, selected empirical literature revealing the causal relationships between the variables is presented. Afterwards, information about the data, model and methodology are given, and the findings are presented. In the conclusion part of the study, the findings are evaluated.

2. Theoretical Framework

The Environmental Kuznets Curve is the most widely accepted approach that theoretically explains the relationship between economic growth and pollution. According to this approach developed by Grossman and Krueger (1991), per capita income and economic growth act in parallel in the first stage. However, after reaching a certain income level, this relationship reverses. Environmental quality is compromised at the expense of achieving economic growth in low-income countries.

Pollution can reach uncontrollable levels, especially in DLC, due to the production structure based on fossil fuel consumption and the lack of regulatory institutions to protect the environment. However, as the income level of society increases, environmental quality is given importance, and emphasis is placed on policies that will reduce environmental degradation. This relationship between environmental degradation and economic growth is theoretically explained by the inverted-U shape of the Environmental Kuznets Curve.

Stern (2004), on the other hand, states that in slower-growing economies, emission-reducing technological changes overcome the scale effect of increasing per capita income. However, in fast-growing middle-income countries, income increase suppresses the emission reduction with technological change. Therefore, even if theoretical expectations differ according to the income level of the countries, the causal relationships between economic growth and pollution are undeniable.

On the other hand, the high dependence on energy in many countries necessitates the development of renewable energy (RE) sources and increases the share of RE in total energy resources. Development goals based on RE sources also coincide with the 2030 Sustainable Development Goals published by the UN and accepted by the world's leading countries (Bilan et al., 2019: 2). Today, since traditional production techniques are harmful to the environment, countries have started to turn to environmentally friendly production techniques supported by renewable resources such as sun and wind (Inglesi-Lotz, 2016:1). Globally initiated strategic policy practices to reduce air pollution have considerably increased energy costs. This situation necessitated a more detailed study of the relations between REC and economic growth. In particular, increased production and REC have begun to be seen as potential endogenous growth engines, such as investments in research and development and human capital. Because economic development based on efficient EC and the share of green energy in energy ensures that economic growth becomes sustainable by increasing its quality (Marinaş et al., 2018: 2), this has been the case in recent years, with government-supported projects such as tax reductions and grants, encouraging growth in RE. Thus, the costs of RE production are reduced, allowing RE to compete with traditional energy sources (Shahbaz et al., 2020:118-162).

The theoretical basis of the relationship between economic growth and EC has been debated for a long time. Stern (2011: 26) states that it is impossible to grasp the direct effect of energy on economic growth without understanding its role in production processes. Therefore, the role of energy in economic production should be evaluated from the physical principles and economic point of view. However, mainstream growth models have been criticized for ignoring energy as an essential factor for production. There is also a lack of theories that attempt to explain growth purely as a function of energy supply. Because, ignoring the roles of knowledge, experience, and institutions, theoretical economic growth approaches based only on energy are also a subject of criticism.

In Solow's (1956) theory of growth, while technology and technology-related factors are external factors that determine economic growth, this situation differs in internal growth theories. In Romer's (1990) model, more emphasis is placed on Research and Development (R&D) activities, and it is stated that the engine of growth is newly developed technological infrastructures. These activities have ensured that factors associated with technology and technical progress are inherently involved in new economic growth models. Although energy is not the only determinant of technology, it is a crucial factor for the use of technology. Because the realization of technological progress depends on energy, in this sense, technologies do not work without sufficient energy sources (Odularu and Okonkwo, 2009:53). Therefore, increasing energy and energy efficiency is vital for new economic growth models. In particular, more R&D activities and technology investments are required to increase the use of RE compared to traditional energy use. This situation causes a direct and indirect link between RE and economic growth.

The relationship between EC or, as in this study, between REC and economic growth is examined under four primary hypotheses (Maji et al., 2019:385-386):

- **Growth Hypothesis:** According to this hypothesis, there is unidirectional causality from EC to economic growth. In this case, EC effects economic growth both directly and indirectly.

For example, RE sources such as solar, wind, hydroelectric, and biomass for sustainable economic growth should be expanded. While developments in RE increase employment opportunities in the public and private sectors, people start to earn more income. This situation increases the economic growth with the expenditure item.

- **Conservation Hypothesis:** It is assumed that there is a unidirectional causality relationship from economic growth to EC. As the economy grows, demand for RE increases due to rising per capita income. In particular, the increase in the total expenditures of households, investors, and the government necessitates RE development.

- **Feedback Hypothesis:** It is assumed that there is a bidirectional causality relationship between REC and economic growth. Accordingly, while economic growth triggers RE, RE also triggers economic growth. According to this hypothesis, there is a complementarity and feedback relationship between the two variables.

- **Neutrality Hypothesis:** There is no causality between economic growth and REC.

3. Literature Review

There is extensive empirical literature investigating the relationship between REC, economic growth, and CO_2 emissions. In this study, while the empirical literature is being created, not to be detached from the study's context, we primarily focused on the studies that carried out causality analysis. Thus, what kinds of findings are obtained regarding causal relationships between the variables are revealed.

A summary of the selected empirical literature is shown in Table 1.

Table 1: Selected Empirical Literature

Author (s)	Country/Period	Method	Causality
Sadorsky (2009)	18 Emerging Economies (1994-2003)	FMOLS, DOSL, OLS, VECM-Granger Causality Test (GCT)	REC≠GDP(SR) GDP→REC (LR)
Apergis & Payne (2010)	13 Eurasian Countries (1992-2007)	FMOLS, VECM-GCT	REC→GDP(SR) REC ↔ GDP (LR)
Menyah & Wolde-Rufael (2010)	USA (1960-2007)	Modified GCT	NEC→ CO_2 REC≠ CO_2
Alam (2013)	25 Countries (1993-2010)	Panel Cointegration, VECM - GCT	DC: CO_2→GDP (SR) DLC: GDP→ CO_2 (SR)
Farhani (2013)	12 MENA Countries (1975-2008)	FMOLS, DOLS, Panel GCT	REC→ CO_2 (SR) REC≠GDP(SR) GDP≠ CO_2 (SR) GDP→REC (LR) CO_2→REC(LR) GDP≠ CO_2 (LR)
Ocal & Aslan (2013)	Turkey (1990-2010)	ARDL, Toda–Yamamoto Causality Test	GDP→REC
Al-Mulali et al. (2014)	18 Latin American Countries (1980-2010)	DOLS, VECM - GCT	REC ↔ GDP
Farhani & Shahbaz (2014)	10 MENA Countries (1980-2009)	FMOLS, DOLS, Panel GCT	REC→ CO_2 (SR) NREC→ CO_2 (SR) REC ↔ CO_2 (LR) NREC ↔ CO_2 (LR)
Sebri & Ben Salha (2014)	BRICS Countries (1971-2010)	ARDL, FMOLS, DOLS, VECM-GCT	REC↔GDP
Jebli & Youssef (2015)	5 North African Countries (1971-2008)	FMOLS, DOLS, Panel GCT	CO_2→GDP(SR, LR) REC→GDP(SR, LR) REC→ CO_2 (SR)
Alper & Oguz (2016)	New EU Member Countries (1990-2009)	ARDL, Hatemi Causality Test	REC≠GDP (5 Countries) GDP→REC (1 Country) REC→GDP (1 Country)
Saidi & Mbarek (2016)	9 DC (1990-2013)	FMOLS, DOLS, Panel GCT	REC→GDP (SR) REC ↔ GDP (LR) GDP→ CO_2 (LR)
Attiaoui et al. (2017)	22 African Countries (1990-2011)	PMG, Panel GCT	CO_2→GDP (SR) CO_2≠REC (SR) REC→GDP (SR) REC ↔ GDP (LR) CO_2GDP (LR) REC ↔ CO_2 (LR)
Shakouri & Yazdi (2017)	South Africa (1971-2015)	ARDL, VECM-GCT	REC ↔ GDP TR ↔ GDP

Author (s)	Country/Period	Method	Causality
Bilan et al. (2019)	Potential Candidates for the EU Membership (1995-2015)	FMOLS, DOLS, VECM-GCT	CO_2 ↔ GDP (SR) REC→GDP (SR, LR) REC ↔ CO_2 (SR) CO_2→GDP(LR)
Chen et al. (2019)	China (1980-2014)	ARDL-GCT	TR ↔ REC (SR) CO_2 ↔ REC (SR) NREC ↔ REC (SR)
Asiedu et al. (2021)	26 European Countries (1990-2018)	FMOLS, DOLS, GCT	REC ↔ GDP REC→NREC REC→ CO_2 GDP→ CO_2
Shahbaz et al. (2020)	38 RE-Consuming Countries (1990-2018)	DOLS, FMOLS, Dumitrescu and Hurlin Panel Causality Test	REC ↔ GDP
REC: Renewable Energy Cons. NREC: Non-Renewable Energy Cons. GDP: Economic Growth CO_2: Carbon Emissions, Pollution NEC: Nuclear Energy Cons. TR : Trade		→ : One-Way Causality ↔ : Bidirectional Causality ≠ : No Causal Relationship SR : Short Run LR : Long Run	

When Table 1, which shows the selected empirical literature, is examined, it is seen that it is not possible to talk about a universal consensus on the causality relationship between REC, economic growth, and CO_2 emissions.

While there are unidirectional and bidirectional relationships between the variables, there are also studies in which no causality relationship can be found. On the other hand, the existence and direction of the relations also differ in terms of short and long term in some studies.

4. Data and Model

This section will give information about the econometric model applied in the study and the variables. Information about the data set and variables used in econometric analyzes to examine the relationships between REC, CO_2, and economic growth are presented in Table 2 Gauss 16 and Stata 12, and Eviews 10 package programs are used in the analysis.

Table 2: Description of Variables

Variables	Description	Source
LCO_2	CO_2 emissions (kt)	World Bank
LGDP	GDP (constant 2010 US$)	World Bank
LREC	Renewable energy consumption (% of total final energy consumption)	World Bank

In this study, predictions of the models specified in Equation (1), (2), (3), and (4) are made.

Model 1:

$$LGDP_{it} = \alpha_0 + \alpha_1 LCO2_{it} + u_{it} \quad (1)$$

Model 2:

$$LCO2_{it} = \alpha_0 + \alpha_1 LGDP_{it} + u_{it} \quad (2)$$

Model 3:

$$LGDP_{it} = \alpha_0 + \alpha_1 LREC_{it} + u_{it} \quad (3)$$

Model 4:

$$LREC_{it} = \alpha_0 + \alpha_1 LGDP_{it} + u_{it} \quad (4)$$

In these models, of i represent units, t research period, α_0 are the constant terms in the models, and u_{it} are the error terms. For the analysis of the study, the data captured from the World Bank World Development Indicators (WDI) database are compiled annually for the period 1998-2018. The reason for taking the data from 1998 is that the starting year of the Kyoto protocol was 1998. The logarithms of the variables to be used in the model are taken.

The relationship between *LREC*, LCO_2, and *LGDP* in BRICS-T countries and G7 countries, which have similar economies, is analyzed with the help of a test developed by Emirmahmutoğlu and Köse (2011), which allows the causality relationship to be examined in heterogeneous panels. Emirmahmutoğlu and Köse (2011) put forward a GCT by considering the LA-VAR approach put forward by Toda and Yamamoto (1995). With the help of this test, the presence or absence of cross-section dependence is examined with Monte Carlo Simulations. These simulations help get robust results even when N and T are small. However, before proceeding to the panel causality analysis, cross-sectional dependence and homogeneity tests should be done in the variables and the models.

5. Methods and Findings

5.1. Cross-Section Dependency Test and Results

Cross-section dependence, in the analysis made with panel data models, expresses the situation that the horizontal section units in the panel are affected to the same degree when the series encounters a particular shock. In determining cross-sectional dependence, Breusch and Pagan (1980) and Pesaran (2004) used some tests. In the study by Breusch and Pagan (1980), test statistics are calculated as in Equation (5) (Pesaran et al., 2008: 107):

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1 \hat{P}_{ij}^2}^{N} \quad \sim X^2 N(N-1)/2 \tag{5}$$

The LM test is valid when the N dimension is small and the T dimension is large. The test statistic developed by Pesaran (2004) is included in Equation (6):

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \widehat{P_{ij}}\right) \tag{6}$$

Under the null hypothesis, the limit of the function $CD \to N(0,1)$ is $N \to \infty$when T is large enough. An alternative (scaled version) LM (CD_{LM}) test is proposed by Pesaran (2004) to be used when the time dimension T is larger than the slice size and also when the difference between the slice size and the time dimension is small. The Pesaran CD_{LM} test statistic is as follows:

$$CD_{LM} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T\hat{p}_{ij}^2 - 1 \sim N(0,1) \tag{7}$$

The hypotheses in cross-section dependency tests are "H_0: There is no cross-section dependency." And "H_1: There is cross-section dependency." is in the form. Cross-section dependency test results are presented in Table 3.

Table 3: Cross-Section Dependency Test Results

Results for BRICS-T Countries							
	LCO_2	*LGDP*	*LREC*	Model 1	Model 2	Model 3	Model 4
Breusch-Pagan LM	236.482*	294.805*	131.477*	99.970*	97.480*	60.020*	59.690*
Pesaran CD LM	40.436*	51.085*	21.265*	37.610*	36.590*	20.160*	19.501*
Pesaran CD	15.281*	17.165*	7.355*	4.587*	4.870*	2.980**	1.961**
Results for G7 Countries							
Breusch-Pagan LM	212.348*	314.376*	336.581*	143.601*	101.200*	165.300*	105.000*
Pesaran CD LM	29.525*	45.269*	48.695*	46.670*	29.970*	54.720*	31.440*
Pesaran CD	7.379*	16.695*	18.261*	8.753*	8.854*	9.842*	6.944*

*Notes: * and ** signs show 1% and 5% significance level respectively.*

When Table 3 is examined, it is possible to say that there is a cross-section dependency in all series and models in the study.

5.2. Stationarity Test and Results

According to the results of the cross-sectional dependence test, it is possible to continue the analyzes with first-generation panel unit root tests in case the H_0 the hypothesis cannot be rejected. However, if the H_0 the hypothesis is rejected; it would be correct to continue the analyzes with the second generation panel unit root tests that take into account the cross-section dependency (Baltagi, 2008: 284).

Since cross-section dependence in all series and models used in the study, there is a cross-section dependency, one of the second generation panel unit root tests, Smith et al. (2004) panel unit root test, is applied.

Table 4: Smith et al. (2004) Bootstrap Test Results

Results for BRICS-T Countries						
	Constant			Constant & Trend		
	LCO_2	*LGDP*	*LREC*	*LCO_2*	*LGDP*	*LREC*
Ips	-5.014*	-4.192*	-5.014*	-4.722*	-4.243*	-3.080**
Max	-3.475*	-4.151*	-4.785*	-3.979*	-4.243*	-3.029*
MinLM	13.377*	11.295*	11.678*	13.617*	11.893*	12.983*
WS	-3.258*	-4.478*	-5.405*	-3.585*	-4.434**	-3.462*
Results for G7 Countries						
Ips	-5.585*	-10.693*	-4.229*	-8.008*	-10.301*	-4.040**
Max	-5.397*	-10.693*	-4.229*	-7.957*	-10.301*	-4.040**
MinLM	15.403*	17.950*	13.143*	17.549*	17.961*	13.286*
WS	-4.528***	-8.642*	-3.690*	-4.346*	-8.314*	-3.514**

Notes:, ** and *** signs show 1%, 5% and 10% significance level respectively.*

The $\bar{t}$ test proposed by Smith et al. (2004) is the bootstrap distribution version of the panel unit root test developed by Im et al. (2003). The hypotheses of the test are "H_0: Series contains the unit root"; it is "H_0: Series are stationary". Smith et al.'s (2004) bootstrap stationary test results are shown in Table 4.

When the panel unit root test results are examined, it is determined that the variables are stationary at the 10% significance level. According to the results obtained, Emirmahmutoğlu and Köse (2011) do not obstacle the causality test. However, first of all, it is necessary to determine whether the slope coefficient of the model is homogeneous or heterogeneous.

5.3. Homogeneity Test and Results

In panel data analysis; Since the data sets have both cross-sectional and time-series dimensions, it is not reasonable to assume that they have no effects on each other in a certain period or that a shock to the time series affects the cross-section units to the same degree.

The delta test, which Pesaran and Yamagata developed (2008) and is used to test whether the slope coefficients are homogeneous (Pesaran and Yamagata, 2008: 67-69):

$$\widetilde{\Delta} = \sqrt{N}\left(\frac{N^{-1}\bar{S}-k}{\sqrt{2k}}\right) \tag{8}$$

Although the delta test has an asymptotic normal distribution, the test statistic is calculated as follows:

$$\widetilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\bar{S}-E(\bar{Z}_{iT})}{\sqrt{Var(\bar{Z}_{iT})}}\right) \tag{9}$$

In the homogeneity test, the hypotheses are "H_0: Slope coefficients are homogeneous" and "H_1: Slope coefficients are heterogeneous". Homogeneity test results are shown in Table 5.

Table 5: Homogeneity Test Results

Results for BRICS-T Countries				
Tests	Model 1	Model 2	Model 3	Model 4
$\widetilde{\Delta}$	22.262*	20.245*	9.194*	12.442*
$\widetilde{\Delta}_{adj}$	24.045*	21.867*	9.931*	13.439*
Results for G7 Countries				
$\widetilde{\Delta}$	16.614*	13.230*	13.819*	12.751*
$\widetilde{\Delta}_{adj}$	17.945*	14.290*	14.926*	13.772*

*Notes: * sign show 1% significance level.*

The findings reveal that the H_0 hypothesis, which expresses the homogeneity of the model in Delta tests, is rejected at the 1% significance level, revealing that the model is heterogeneous. These results indicate that the impact of a change in the indicators of *LREC* and *LCO₂* on *LGDP* differs in each section.

5.4. Bootstrap Panel Causality Test and Results

Emirmahmutoğlu and Köse (2011) developed a bootstrap panel GCT by extending the time series Toda and Yamamoto (1995) test for panel data. This method considers the panel's heterogeneity and the dependence between the sections and can be applied to stationary series of different orders.

In the process of this test, firstly, the heterogeneous panel VAR (k_i) model with p variable is used (Emirmahmutoğlu and Köse, 2011: 871-873):

$$z_{i,t} = \mu_i + A_{i1}z_{i,t-1} + \cdots + A_{ik_i}z_{i,t-k_i} + u_{i,t}, \quad i = 1,2, \dots, N; t = 1,2, \dots, T \tag{10}$$

The i index represents the section size in the VAR model, and the t index represents the time dimension. While the term μ_i is a p-dimensional vector of fixed effects, $A_{i1}, \dots, A_{ik_i}$ is expressed as a constant (p × p) matrix of parameters varying between cross-sections. $u_{i,t}$ is the column vector of the p error terms.

The unit root of the variables in the VAR model causes non-standard asymptotic distributions that include coefficient problems in Wald statistics. In this case, the GCT loses its reliability for non-stationary variables. Toda and Yamamoto (1995) developed the LA-VAR model as an alternative approach to eliminate this problem. In heterogeneous mixed panels, the VAR ($k_i + d_{max_i}$) model is estimated as follows:

$$z_{i,t} = \mu_i + A_{i1}z_{i,t-1} + .. + A_{ik}z_{i,t-k_i} + \sum_{l=k_i+1}^{k_i+d_{max_i}} A_{i1}z_{i,t-1} + u_{i,t}, \quad i = 1,2, .., N; t = 1,2, \dots, T \tag{11}$$

In heterogeneous mixed panels, the ($k_i + d_{max_i}$) delayed VAR model is defined as:

$$x_{i,t} = \mu_i^x + \sum_{j=1}^{k_i+d_{max_i}} A_{11,ij}x_{i,t-j} + \sum_{j=1}^{k_i+d_{max_i}} A_{12,ij}y_{i,t-j} + u_{i,t}^x \tag{12}$$

$$y_{i,t} = \mu_i^y + \sum_{j=1}^{k_i+d_{max_i}} A_{21,ij}x_{i,t-j} + \sum_{j=1}^{k_i+d_{max_i}} A_{22,ij}y_{i,t-j} + u_{i,t}^y \tag{13}$$

d_{max_i} in equations 12 and 13 show the highest integration level that occurs in the system for each i.

Table 6 shows the causality results for the overall panel in the BRICS-T and G7 countries. Accordingly, no causality relationship is found for the panel in general in the BRICS-T countries. The panel of G7 countries determined that there is a unidirectional causal relationship from *LREC* to *LGDP* for the panel in general.

Table 6: Emirmahmutoğlu & Köse (2011) Panel Fisher Test Results

Results for BRICS-T Countries			
Model	Panel Fisher	Bootstrap Probability	Asymptotic Probability
LCO_2 => *LGDP*	20.187	0.100	0.064
LGDP => LCO_2	25.338	0.930	0.013
LREC=> *LGDP*	94.763	0.178	0.000
LGDP => *LREC*	67.392	0.210	0.000
Results for G7 Countries			
Model	**Statistics**	**Bootstrap Probability**	**Asymptotic Probability**
LCO_2 => *LGDP*	76.656	0.790	0.000
LGDP => LCO_2	106.275	0.761	0.000
LREC=> *LGDP*	155.997	**0.010**	0.000
LGDP => *LREC*	43.449	0.585	0.000

After the panel general results, Table 7 shows the country-specific bootstrap panel causality analysis results. Accordingly, a related causality runs from *LGDP* to LCO_2 emissions in China and India. Any change in economic growth in these countries affects environmental degradation. As Grossman and Krueger (1991) stated, environmental quality is compromised at the expense of economic growth in DLC. In addition, these results are in line with the findings obtained in the studies of Alam (2013) and Asiedu et al. (2021). In the Russian Federation, South Africa, and Turkey, significant causal relationships from LCO_2 to *LGDP* are determined. This result supports the finding of Jebli & Youssef (2015) in their study.

On the contrary, for the G7 countries, which are shown as the world's most developed economies, there are bidirectional and significant causal relationships between LCO_2 and *LGDP*. According to the findings obtained in the studies of Attiaoui et al. (2017) and Bilan et al. (2019), the relationship between environmental degradation and economic growth in G7 countries has entered a process that feeds each other. These results show that the causal relationship between economic growth and environmental degradation is undeniable, regardless of the countries' development level.

However, while one-way causal relationships are found chiefly in DLC, this relationship is bidirectional in DC. Although DC has started to increase REC investments, EC based on fossil fuels is still at high levels. (BP Statistical Review of World Energy, 2021). Therefore, the relationship between economic growth and environmental degradation continues to be essential for all countries of the world.

Table 7: Emirmahmutoğlu & Köse (2011) Causality Test Results

Results for BRICS-T Countries						
Model	**Countries**	**Wald Statistic**	**Probability**	**Model**	**Wald Statistic**	**Probability**
LGDP => LCO_2	Brazil	0.424	0.515	*LCO_2 => LGDP*	3.904	0.419
	China	8.989	**0.061**		4.178	0.382
	India	9.827	**0.043**		3.674	0.452
	Russia	0.924	0.336		10.584	**0.032**
	South Africa	1.048	0.306		11.187	**0.025**
	Turkey	1.108	0.293		9.216	**0.056**
LGDP => LREC	Brazil	5.046	**0.025**	*LREC => LGDP*	0.127	0.721
	China	6.029	**0.014**		0.252	0.616
	India	6.605	**0.010**		0.186	0.667
	Russia	26.826	**0.000**		23.898	**0.000**
	South Africa	27.797	**0.000**		30.132	**0.000**
	Turkey	31.401	**0.000**		26.948	**0.000**
Results for G7 Countries						
LGDP => LCO_2	Canada	9.931	**0.042**	*LCO_2 => LGDP*	21,858	**0.000**
	France	9.470	**0.050**		15,135	**0.004**
	Germany	11.051	**0.026**		8,698	**0.069**
	Italy	14.000	**0.007**		11,013	**0.026**
	Japan	30.584	**0.000**		21411	**0.000**
	UK	30.400	**0.000**		15,612	**0.004**
	USA	32.672	**0.000**		12,518	**0.014**
LGDP => LREC	Canada	6.512	0.164	*LREC => LGDP*	34,919	**0.000**
	France	5.766	0.217		29,110	**0.000**
	Germany	6.044	0.196		26,883	**0.000**
	Italy	7.790	**0.093**		21,892	**0.000**
	Japan	10.063	**0.039**		21,577	**0.000**
	UK	15.407	**0.004**		20,572	**0.000**
	USA	15.560	**0.004**		20,863	**0.000**

On the other hand, there are bidirectional causal relationships between *LGDP* and *LREC* in DLC like Russia, South Africa, Turkey, and DC such as Italy, Japan, the United Kingdom, and the United States. These findings show that the feedback hypothesis, one of the hypotheses related to energy and growth stated by Maji et al. (2019), is valid in developed and DLC. These findings are consistent with Apergis & Payne (2010), Al-Mulali et al. (2014), Sebri & Ben Salha (2014), Shakouri & Yazdi (2017), Asiedu et al. (2021), and Shahbaz et al. (2020) supports the findings of their studies.

Additionally, unidirectional causal relationships from *LGDP* to *LREC* are found in Brazil, China, and India. This result reveals that the conservation hypothesis is valid in some DLC. These findings are similar to Sadorsky's (2009) and Ocal & Aslan's (2013) studies. Also, one-way causality relationships from *LREC* to *LGDP* are determined in Canada, France, and Germany, which are among the DC. Jebli & Youssef (2015), Bilan et al. (2019) similarly found in their studies that *LREC* is the cause of *LGDP*. These results reveal that the growth hypothesis is valid for Canada, France, and Germany.

As a result, the conservation hypothesis is valid in DLC, and the growth hypothesis is valid in DC while the feedback hypothesis is valid in both DC and DLC. While an increase or decrease in economic growth in DLC is the cause of REC, an increase or decrease in REC in DC is the cause of economic growth. These results show that REC has an important place in the economic growth of DC. In DLC, however, this mechanism has not been strengthened yet.

6. Conclusion

The relationship between REC, CO_2 emissions and economic growth is essential for a country at every income level. This study examined the relationship between CO_2 emissions, REC, and economic growth in the 1998-2018 period. Variables are analyzed with the help of the test developed by Emirmahmutoğlu & Köse (2011), which allows the causality relationship to be examined in heterogeneous panels. In the panel data analysis studies on the subject using similar variables, the relations between the variables are evaluated as a whole. This study examined the causality between economic growth, CO_2 emissions, and REC in a country-specific manner, thanks to the method used. Thus, it is possible to say that the relationships between the variables are revealed more healthily.

According to the analysis results, no causality relationship is found for the overall panel in the BRICS-T countries. On the other hand, for the G7 countries, a unidirectional causal relationship from REC to economic growth is determined for the panel in general. When country-specific bootstrap panel causality analysis results are analyzed, there is a causal relationship between economic growth to CO_2 emissions in China and India and CO_2 emissions to economic growth in Russian Federation, South Africa, and Turkey. For G7 countries, there are bidirectional and significant causal relationships between CO_2 emissions and economic growth. In contrast, there is a bidirectional causal relationship between economic growth and REC in DLC such as Russia, South Africa, Turkey and DC Italy, Japan, the United Kingdom and the United States. In addition, unidirectional causal relationships from economic growth to REC are found in DLC like Brazil, China and India. A one-way causal relationship from REC to economic growth is determined in Canada, France, and Germany.

As a result, it is concluded that while the feedback hypothesis is valid in both DC and DLC, the conservation hypothesis is valid in DLC, and the growth hypothesis is valid in DC. While economic growth is the cause of REC in DLC, REC is the cause of economic growth in DC. These results show that REC has an important place in the economic growth of DC. In some DLC this mechanism has not been strengthened yet.

A significant portion of the harmful greenhouse gases released into the atmosphere in the world belongs to the G7 and BRICS-T countries. Therefore, regardless of the level of development and carbon risk, it is necessary to reduce the share of fossil fuel consumption in total EC and invest in RE sources to achieve sustainable growth. In particular, BRICS-T countries should create long-term standard or country-based policies that will transform RE and implement these plans with determination. In this direction, incentivizing the private sector to provide cost advantages for RE investments will accelerate this transformation process. In addition to increasing R&D expenditures, it is also vital to strengthen human capital to increase energy efficiency. Activation of endogenous growth factors will contribute to a better quality of economic growth.

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CURRENT DEBATES ON
SUSTAINABLE DEVELOPMENT

This book aims to evaluate current approaches on the sustainable development. Considering historical change in the concept of development, the importance and necessity of adopting a human development and sustainable development approach have more recently emerged. The distribution and level of the production factors as main source of economic growth differ in developed and developing countries. Economic growth and development processes that emerge from this difference should be considered in the context of sustainability. Moreover, climate change and environmental problems are fundamental challenges for our world. Environmentally friendly policies, renewable energy, green capitalism, cleaner production and consumption processes should be addressed within the concept of sustainable development. Thus, we can recommend effective policies to the developing countries for alleviating poverty and inequality.

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PINAR HAYALOĞLU
SEYFETTİN ARTAN

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CURRENT DEBATES ON SUSTAINABLE DEVELOPMENT

This book aims to evaluate current approaches on the sustainable development. Considering historical change in the concept of development, the importance and necessity of adopting a human development and sustainable development approach have more recently emerged. The distribution and level of the production factors as main source of economic growth differ in developed and developing countries. Economic growth and development processes that emerge from this difference should be considered in the context of sustainability. Moreover, climate change and environmental problems are fundamental challenges for our world. Environmentally friendly policies, renewable energy, green capitalism, cleaner production and consumption processes should be addressed within the concept of sustainable development. Thus, we can recommend effective policies to the developing countries for alleviating poverty and inequality.

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Editors
PINAR HAYALOĞLU
SEYFETTİN ARTAN

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