

The role of government expenditure on environmental improvement A case study of Egypt

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Abstract

This paper aims at observing the recent trends in government expenditure on environmental improvement. In order to achieve this goal, previous studies and more recent ones in particular were reviewed. Relevant modern terms such as the green growth economy, the circular economy, sustainable development and environmental sustainability were also introduced.

This study concluded that the effectiveness of the role of government expenditure on environmental protection depends to a great extent on governance quality, the actual institutional performance and the public expenditure structure. This result was further supported by the case study findings.

The case study explored the long term and the short term effects of government expenditure on environment performance in Egypt during the period extending from 1990 to 2017. The co-integration method was applied via using the autoregressive distributed lad (ARDL) model. Results revealed a negative impact of per capita government expenditure on genuine wealth per capita (as a measure of weak environmental sustainability) in the long run. Moreover, the study found a positive relationship between per capita government expenditure and per capita ecological deficit (as a measure of strong environmental sustainability) in the long run.

Keywords: *Government expenditure, environmental performance, Weak environmental sustainability, strong environmental*

sustainability ,green economy, ARDL model, circular economy, sustainable development, ecological deficit, green bonds

1. Introduction

1.1. Evolution of the role of government expenditure on environmental protection

The role of government expenditure on environmental protection and pollution abatement evolved through several stages. At first, when developing countries obtained their independence, their focus was on realizing economic development and moving from underdevelopment to economic growth. Industry was then considered the engine of growth and without industry no progress could be realized. (See for instance, Mohammed Zaki El-Shafei, 1996). Government expenditure was not concerned with environment at that time.

However as time passed, per capita national income proved to be an unsatisfactory measure of economic development and the need to stress the importance of the human factor became more compelling. Therefore, a compound index of human development was devised, incorporating three elements: Per capita gross domestic product (GDP), the level of educational services and the size of health care services provided to the community individuals.

Then the concept of sustainable development emerged, to put in focus the needs of future generations, and not just the needs of the present generation, when planning economic development. In addition, sustainable development underscores the importance of environment protection and pollution abatement, since environment degradation may negatively affect economic development in the future (T. R. De Gregory, ed. 1989).

At the international level, the Organization for Economic Cooperation and Development (OECD) has been, since the 1970's, encouraging the governments of member countries to formulate, coordinate and implement effective and sustainable environmental policies based on, inter alia, an integrated system for making environmental and economic decisions. Hence, after holding numerous meetings and conferences over many years, the Organization for Economic Cooperation and Development reached in October 2001 the following three basic concepts.

1.2. Important concepts of public expenditure on environmental protection (OECD, 2007)

(1) **Pollution Abatement and Control Expenditure (PACE)** refers to the expenditure devoted to the activities that directly aim at preventing, mitigating and eliminating pollution and any other form of disturbance caused by the wastes resulting from the production or consumption of goods and services.

(2) **Environmental Protection Expenditure (EPE)** refers to expenditure on all the activities that directly aim at preventing, mitigating and eliminating pollution and any other environmental degradation resulting from the production or consumption of goods and services. The scope of environmental protection is determined according to the *Classification of Environmental Protection Activities (CEPA)* including the following nine fields of environmental activity:

1. Protection of the ambient air and climate
2. Wastewater management
3. Waste management
4. Protection and remediation of soil, groundwater and surface water
5. Noise and vibration abatement
6. Protection of biodiversity and landscapes
7. Protection against radiation (excluding external safety)
8. Research and development
9. Other environmental protection activities.

(3) **Environment al Protection Expenditure** covers expenditure on environmental management activities concerning all the above-mentioned fields of environmental protection activity.¹

(4) **The concept of biodiversity**

Biological diversity or biodiversity is the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and diversity of ecosystems.

Hence, biodiversity includes all living organisms from micro-organisms to large trees and huge whales. Moreover, living organisms

¹ The relationship between these three concepts is the following: PAC includes reducing air, water, soil, noise and radiation pollution. EP covers PAC activities in addition to the protection of biodiversity and landscapes. Environmental Management concerns the nine above-mentioned fields of activity.

depend on and interact with their ecosystems. Therefore , the greatest biodiversity can be found in equatorial forests where hot weather, abundant rainfall water, and fertile soil support the proliferation of various species of plants, animals, insects and micro-organisms; whereas due to the harsh cold weather, mostly frozen water and scarce resources at the North Pole and the South Pole, biodiversity is tremendously reduced.

Biodiversity in Earth faces serious dangers and threats. A major cause lies in human misbehavior and the consequent damage incurred by nature. Agricultural lands are being destroyed to accommodate the ever growing tide of urban and industrial expansion. Huge trees have been cut down or badly mutilated, especially in equatorial forests, to obtain wood for heating purposes. Actually, human activities have seriously affected all environmental elements through spreading air, water, noise (sound) and radiation pollution. As a result, climates have been disturbed and conditions for the protection of biodiversity have been impaired in many parts of our World. In addition, aggressive and unorganized fishing and hunting have driven several species to near extinction.

In order to preserve biodiversity, we need to overcome its threatening factors. This can be done in a number of ways and mainly the following:

- Using renewable energy; using environment-friendly products; restricting outrageous fishing and hunting; preventing fishing and hunting of species threatened with extinction; avoiding urban invasion of flora and fauna rich regions, and extending urban development to unexploited and desert regions instead; avoiding the use of chemicals such as fertilizers and insecticides which could be detrimental to the environment; consuming organic and natural food products; reducing all sorts of pollution, whether at the private or public level, through waste recycling, reducing the use of chemicals which are detrimental to the environment; economizing on energy consumption, since energy is mostly produced through the combustion of petroleum-derived products that increases environmental pollution and harms biodiversity.

These concerns led to the concept of the green growth or the green economy.

(5) The concept of the green growth or the green economy

The European Commission defines the green economy as the economy that is able to secure growth and development, and at the

same time improve human welfare, provide convenient jobs, reduce inequity, eradicate poverty, and preserve the natural capital supporting the economy. Such an economy would induce a specific move towards an economy that better recognizes the economic opportunities that could be made available by green policies, markets and trading practices. In many cases, the environment becomes an engine of sustainable growth and development, instead of representing a cost to the economy.¹

The United Nations Environmental Program states that the **green economy** aims at improving “welfare and social equity while reducing environmental risks and environmental scarcity to a great extent.”(UNDP, 2011)

The green economy stresses the need to invest in natural capital, and the necessity of observing sustainable consumption and production practices .Within this framework, the circular economy is not only a way for realizing environmental goals, but it also contributes to speeding up sustainable economic growth and generating new jobs. Moreover, the circular economy arouses the case for a more active role of the private sector in the transformation process as promoted by the development policies of the European Union.²

In December 2015, the European Commission adopted a plan of action for launching the circular economy, known as the **Circular Economy Action Plan (CEAP)**. The CEAP represents a major contribution to the efforts of the European Union in view of developing a competitive and sustainable economy with a low level of carbon emissions and an efficient use of resources. This endeavor may be seen as a real opportunity for transforming Europe’s economies and generating new and sustainable competitive advantages.³

(6) The Circular Economy Concept

The CEAP defines the circular economy as “the transition to a more circular economy in which the values of products, materials and resources are kept in the economy for as long as possible, and in which

¹ European Commission.’Rio+20: Towards the green economy and better governance,’ communication 2011.

² United Nations, ‘Transforming our world: The 2030 AGENDA FOR Sustainable development,’ 2015

⁴ EC, ‘Closing the loop- An EU Action Plan for the Circular Economy,’ Communication, 2015.

waste generation is reduced to the minimum possible level.” Therefore, the circular economy is considered an essential element of the green economy. In other words, while the circular economy focuses on waste management and waste reduction to the minimum possible level, as well as on promoting the efficient use of economic resources, the green economy incorporates those three principles in addition to aspiring to human welfare and ecosystem resilience¹

The changing global climate and increasing environmental pollution instigate governments to find new ways for achieving sustainable development. The green economy is an effective method for realizing sustainability through focusing on economic growth, preserving resources and protecting the environment. (Fay, M., 2012; Bagheri et al., 2018; Yi and Liu, 2015; Matraeva et al., 2019; Yang et al., 2019)

The concepts of sustainable development and the green economy are rapidly becoming a major concern and an issue of utmost importance at the global level. Many governments consider sustainable development an essential requirement and an integral strategic goal including three pivotal dimensions, the economic, social and environmental dimensions; and involving present and future time perspectives. Therefore, achieving sustainable development and the green economy necessitates concerted efforts at the individual, community, regional, governmental and international levels.

Moreover, in order to realize sustainable development and the highest levels of welfare and modernism, governments have to adapt their development plans and economic and social reforms to the requirements and time horizons of sustainable development. Financing development schemes acquires prime importance in catering to the needs of sustainable development. Hence, financial resources must be directed, controlled and structured along the lines of the set goals of sustainable development. Financial amounts allocated to the activities which lead to the depletion of natural resources should be curtailed while bigger amounts should be spent on promoting and incentivizing innovation and green investments. Governments also need to spend more on education and scientific research, and on enhancing human capabilities through learning and training.

⁵European Environment Agency, The European Environment – state and outlook, 2015

Public expenditure and investment policies are considered the most important tools of public finance. They usually aim at capital accumulation in view of increasing national wealth and implementing developmental plans and policies. Therefore, public investment funds should be rationalized and allocated to the vital sectors which may contribute to building up the green economy, away from the depletion of non-renewable resources. The green economy is also concerned with the promotion of clean technologies and renewable energies in order to replace income-generating resources, whether at the local consumption or the export level. Moreover, this policy targets the improvement of individual and community welfare, through providing basic needs, such as education, health care, housing, and infrastructure, in adequate quality and quantities. Furthermore, reducing pollution is a major concern of the green economy policy, through restricting projects entailing high pollution, encouraging environment-friendly projects, and providing the necessary capabilities for a cleaner environment.

In this regard, *green bonds* were issued to finance projects that have positive environmental and/or climate impact.⁶

In recent years, government expenditure has been climbing up in many countries since environment protection offers little incentive to private sector investments (Lopez et al., 2011). Given that background (deteriorating environmental conditions) and the uncertainty of the global economy recovery, the case for a sustainable or a green economy was adopted by developed and developing countries, numerous international organizations, including the United Nations, as well as by active entities of the civil society and academic circles, in the hope of treating those two looming crises. Often these two terms – green growth and sustainable development - are interchangeably used, in alluding to a set of ideas (Bina O., 2013).

Today the world is confronted with unprecedented economic crises and social and environmental challenges. These problems and challenges may differ from one country to another and from one region to another; whereas the global environment degradation is affecting all regions in the world and is linked in complex ways with their various economic and social systems and conditions. Environmental degradation is the result of the current human life styles and unsustainable production and consumption systems. It has become a global phenomenon with wide reaching consequences on inhabitants' welfare around the whole world. This situation calls for an evolution from the isolated growth scheme consisting of endeavors to maximize

certain economic benefits to a more comprehensive and integral scheme covering the far-reaching dimensions of sustainable development.

In the past, macroeconomics focused on explaining the dynamics of inflation, employment, growth and exchange rates and similar mechanisms. In order to devise a new set of policies axed to the realization of the green economy, and covering almost all the aspects of production and consumption in the economy, so that the whole macroeconomic system itself needs to be changed. (See for example: Vines et al., 2018).

The United Nations Conference on Sustainable Development (Rio +20) took place in Rio de Janeiro on June 20-22, 2012. The Conference considered the green economy as one of the important tools for achieving sustainable development. Furthermore, the Conference adopted ground-breaking guidelines on green economy policies (Barbier, 2012; Loiseau et al., 2016).

Financing represents one of the major determinants of the green growth economy. Issuing green bonds is one of the most important modern trends in this context. Year 2020 marked the first issue of green bonds in Egypt, launched by the Commercial International Bank (CIB). It is expected that the Egyptian Ministry of Finance will follow suite with its first bond issuing in Year 2020-2021. This initiative has long been aspired to by the public and the private sectors in Egypt in view of diversifying financing sources and making low-interest financing available to the targeted projects. One of the projects to be financed by the green bonds issued by CIB in Egypt aims at building energy-saving houses. The International Finance Corporation (IFC) will be providing CIB with the necessary know-how for financing climate projects, setting domestic standards and criteria, calculating savings of greenhouse gas emissions, financing green housing projects and preparing reports concerning green bonds. Renewable energy projects are of prime importance on the green economy agenda.

A green bond is a type of fixed –income instrument that is especially earmarked to raise money for climate and environmental projects. These bonds are typically asset-linked and backed by the issuing entity’s balance sheet, so that they usually carry the same credit rating as their issuers’ other debt obligations.

The World Bank was the first international organization to issue green bonds in 2006. Since then, it has issued green bonds estimated at

the equivalent of more than thirteen billion US dollars in twenty different currencies, via more than 150 transactions. At the global level, the issuance of green bonds and social and sustainable development bonds was gaining momentum and steadily rising until the covid-19 virus hit the world population and the global economy in 2020.

The total value of those bonds was expected to reach a high of 400 billion US dollars by the end of year 2020, based on an expected increasing rate of 24 %, with green bonds alone amounting to 300 billion US dollars. However during the first five months of year 2020, the value of green bonds dropped by 36% to a low of 66.6 billion dollars, as compared to the amount of 261.9 US dollars achieved during the same period in year 2019. With the mounting wave of the virus, financial institutions reduced their issued instruments to half their value, while banks turned their attention to supporting their current clients who were facing the challenge of a lagging economy.

Moody's Agency lowered their expectations concerning the sales of green bonds from 300 billion US dollars to from 175 to 225 billion US dollars in year 2020. That drop in green bonds' value became the global trend. In Japan, the value of newly issued green bonds may be decreased in 2020 for the first time in at least the last seven years, although a quarterly register of green bonds had been issued for the period January-March 2020 amounting to 2.7 billion dollars , according to S&P.⁷

Previous studies proved that the changing structure of financial expenditure had a strong impact on the economy, in addition to its effect on environmental pollution. However, the relationship between financial expenditure and the growth of the green economy has not been analyzed in a systematic way. In other words, we need to answer the question: How does the reallocation of financial expenditure funds influence the growth of the green economy, and what are the most influential channels in this respect?

Certain environmental studies, such as Hua et al., 2018; and Lopez et al., 2011, defined the expenditure channels having the greatest impact on the growth of the green economy as follows:

First: Increasing the amounts spent on public goods may incentivize economic growth leading to higher pressures on the environment and impeding the growth of the green economy, due to what is called the *scale effect*. Thus, the relationship between public

expenditure and the growth of the green economy is an indirect relationship, occurring through the impact of public expenditure on economic growth and the subsequent relationship between income levels and pollution, known as the hypothesis of the *Environmental Kuznets Curve (EKC)*.

Environment protection and its relationship to economic performance became a pivotal issue in national and international forums and policy-making debates over the past decades. The Environmental Kuznets Curve shows that the environment quality improves with the increase of income once the economy exceeds the income threshold. However, in a State of poor institutional quality, the income curve may not encounter a turning point; i.e., the effect of economic growth on pollution remains a positive effect all along the curve (Moshiri, S. and Daneshmand, A., 2019).

On the other hand, some items of public expenditure directly promote a clean and healthy environment. Governments usually subsidize public environmental utilities, such as the basic requirements of water and wastewater drainage (OECD, 2007). Governments also spend on water desalination projects; and they exert efforts for using clean energy and renewable energy sources. Public spending on health care aims at protecting the health of citizens and workers who represent the human wealth and form part of the genuine wealth of any country. This kind of government expenditure on (financing public goods) has a positive effect on environmental quality.

Second: Government expenditure on education speeds up the transformation from capital-intensive industries to labor-intensive activities, leading to the *composition effect* which probably mitigates environmental pollution and marks a new launching point for economic growth (Dissou et al., 2016).

Third: Increasing government expenditure on research, development and innovation may entail the adoption of cleaner technologies, such as the *pro-environmental technologies* and clean energies, thus improving the efficiency of resources during the production process and eventually decreasing the ratio of pollution to outputs (Sanberg et al., 2019). This influence is known as the *technology effect*.

The influence of the composition effect (via human capital formation) may be somewhat stronger than the technology effect realized through the adoption of a clean technology (Hua et al., 2018).

The above-mentioned aspects clearly show the critical role of government expenditure on environment protection and quality improvement which represents an important item of government expenditure. Therefore government expenditure policies may have a material indirect effect on the economy. Such an effect should be taken into account in the assessment of the policy effectiveness and its impact on the total benefits gained by the society (Pan, X. et al., 2020).

A new concept emerged known as environmental sustainability.

(7) Environmental Sustainability

There are many definitions of environmental sustainability. Perhaps the most important is that of the *International Union for Conservation of Nature (IUCN)* who defines sustainability as the ability to improve the quality of human life while existing within the absorptive capacity of the environmental systems supporting the Earth.

The *World Commission on Environment and Development* defines sustainable development as follows:

“Sustainable development meets the needs of the present generation without compromising the ability of future generations to meet their own needs.”

The main changes entailing environment degradation are essentially the changing global climate, the loss of biodiversity at an unprecedented rate and the current unsustainable production and consumption patterns.

Therefore environmental sustainability aims at:

a) Meeting societal needs by abstaining from the production of outputs which may harm future generations; designing and providing goods and services liable to make the economy more sustainable; creating job opportunities; supporting the local labor force; promoting moderate trade; and considering environmental sustainability an essential requirement when choosing raw materials and components for the production of new goods and services.

b) Preserving biodiversity by choosing the raw materials which preserve the biodiversity of natural resources; using sustainable and environment-friendly energy sources; and investing in energy efficiency improvement projects.

c) Taking into consideration the renewing capacity (biocapacity) by using renewable sources at rates that are compatible with the capacity of the natural systems producing them; and depleting non-renewable

sources at lower rates than the renewing rates of the substitute renewable sources.

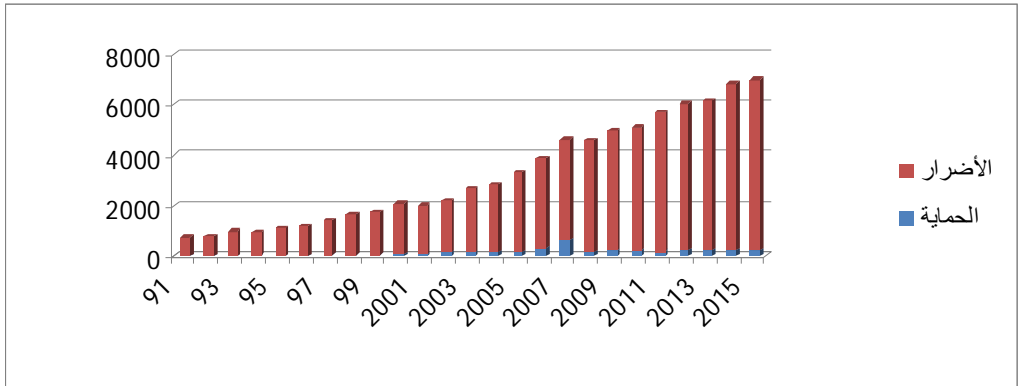
d) Recycling by innovating designs for reusing and recycling products; and designing industrial and trading processes as closed circle systems in order to reduce waste and harmful emissions.

e) Restricting the use of non-renewable materials and reducing waste production by keeping inhabitants' increasing rates and per capita consumption rates, and the rate of technological progress within the absorptive capacities of the environment, while taking into consideration environmental sustainability; in addition to keeping the quantities of waste and emissions within the absorptive capacity of environmental systems without reducing their capacity to absorb waste in the future, or negatively affecting other important environmental services; setting standards for the means of transportation while giving priority to the means of transportation which have a low detrimental effect on the environment; and making all the necessary decisions concerning the production and management of products while taking into consideration the environmental effects of these products throughout their life cycle.

The case of Egypt

In Egypt, government expenditure on the environment played only a modest role during the past years. *Figure (1)* shows how little was spent on environment protection in comparison to the damage resulting from carbon dioxide emissions. That damage was estimated at 6809.5 million US dollars in 2015 whereas government expenditure on the environment stood at 211.15 million US dollars in the same year, i.e. only 3.1% of the damage incurred by the environment. Furthermore, throughout the time series extending from 1991 to 2015, the ratio of government expenditure on the environment to the damage resulting from carbon dioxide emissions ranged from a minimum of 1.9% in 1993 to a high of 15.8% in 2007 which is still a very low ratio. It is noteworthy that carbon dioxide emissions are only one of many kinds of pollutants. (Based on the data issued by the Egyptian Ministry of Finance, the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS) and the World Bank).

Figure (1): Environment Damage and Protection



The present paper aims at investigating the new trends in the role of government expenditure on environment protection and quality improvement and the possibility of their application in Egypt in view of enjoying a clean environment and achieving a reasonable rate of economic growth within the framework of economic and environmental sustainability and reaching out for the realization of the green economy. The green economy and environmental sustainability are considered the two wings of environment quality improvement.

The applied part of this study used the data of time series extending from year 1990 to year 2017 to measure the impact of government expenditure on environmental performance. This research paper is structured as follows:

Following the Introduction, an overview of previous studies relevant to the present subject is displayed in Section 2; the study model and variables are described in Section 3; the econometric analysis and the empirical results are presented in Section 4; the conclusion and deductions are discussed in Section 5.

2. Previous studies:

In this paper previous studies are classified as follows:

- (1) The most important studies tackling the role of government expenditure in reducing pollution and protecting the environment;
- (2) Studies focusing on the relationship between government expenditure and the green (growth) economy; and
- (3) The main studies discussing government quality and political trust and their role in boosting government expenditure on environment protection and towards achieving environmental sustainability.

Although government expenditure may have an important impact on the environment, the relationship between these two variables has not been duly discussed in the relevant literature. It is only recently that relationship began drawing attention. The impact of government expenditure on the environment can be divided into direct and indirect effects. In particular, indirect effects occur through the effect of government expenditure on economic growth and the consequent relationship between income levels and pollution, known as the hypothesis of the Environmental Kuznets Curve (EKC). As aforementioned, the Environmental Kuznets Curve maintains that environmental quality improves with the increase of income once the income level exceeds a given threshold.

There is an infinite number of studies around the world, revolving around the EKC but the results vary due to the different kinds of pollutants studied and the different research methodologies applied. However it is widely believed that governments can overcome the failure of market forces to protect the environment through government expenditure. Although to what extent financial policies concerned with the environment can actually improve environment quality is still not clear and the number of studies dealing with this issue is limited.

In this context, the study of **Moshiri, S. and Daneshmand, A., 2019** used the environmental footprint data as an indicator of environmental sustainability in Iran, a developing country, and they applied the ARDL model to that data. They studied first the relationship between economic growth and environmental quality, within the framework of the Environmental Kuznets Curve. The effectiveness of government expenditure in achieving environment protection was then analyzed. No evidence of the existence of a turning point in the relationship of pollution to income was found. Moreover, the impact of government expenditure on the reduction of the environmental footprint proved to be insignificant. I think that the structure of the economy and its poor institutional quality may explain those results.

Environmental economics underscore that the natural environment has a given total bearing capacity (the biological capacity) that limits the maximum sustainable level of economic activity. Therefore two main factors should be taken into consideration when studying the impact of government expenditure on pollution, namely: The current output level of the economy in relation to the maximum environmental

sustainability level; and the influence of an expansionary financial policy on the economic activity.

Recent studies analyzed the role of government expenditure in reducing pollution. **Hua et al., 2018** used data at the city level in China and studied whether spending on education influenced air pollution via the accumulation of human capital (*the composition effect*); and whether spending on research and development influenced air pollution through the adoption of clean technologies (*the technology effect*).

The *IPAT* formula is widely used to describe the impact of human activities on the environment. According to that formula, impacts on ecosystems (**I**) are the product of the population size (**P**), affluence (**A**) and technology (**T**) of the population in question. The IPAT formula is a mathematical equation and does not allow testing the data-based hypothesis. Therefore, a stochastic version of IPAT was used, known as STIRPAT (STochastic Impacts by Regression on Population, Affluence and Technology) to assess the impact of the economic society on the environment. Hence the basic STIRPAT model could be written in logarithmic form. Contrary to theoretical expectations and empirical evidence, the study results showed that the principal effects were insignificant in urban regions. Moreover, the composition effect appeared slightly stronger than the technology effect.

Two earlier studies had investigated that relationship: **Haikos and Paizanos, 2013**; and **Lopez et al., 2011**. One of the latest studies in this respect is the one carried out by **Pan, X., et al., 2020 on the Chinese economy**. The researchers estimated a multiple-regions *dynamic stochastic general equilibrium (DSGE) model* while applying a simultaneous equations system. The researchers chose a specific region in China as an example for explaining the dynamic impact of the environmental expenditure shock and its indirect effects. The study concluded that the environmental expenditure had a crowding impact on consumption and investment within the local region; but had some positive effects on the economy of external regions. The environmental expenditure shock in the local region may explain the fluctuations in real output and social investment over the last fifty-two quarters; whereas the environmental expenditure shocks in external regions had little to do with output and investment fluctuations in the local region.

One of the interesting findings of that study was that government expenditure had a large positive impact on pollution reduction in the local region; however such environmental expenditure shocks in the

local region entailed greater negative indirect impacts on pollution in the external regions.

Huang, Jr-T., 2018 is another recent study concerned with the investigation of the relationship between government expenditure and environment protection. That study drew the attention to a critical yet seldom discussed issue regarding sulfur dioxide (SO₂) emissions in China, while taking into consideration the potential spatial dependence of sulfur dioxide emissions. Panel data taken from 30 counties over the time period 2008-2013 were used to estimate the spatial Durbin dynamic panel models. That study mainly concluded that sulfur dioxide emissions can be effectively reduced through government expenditure on environment protection; and that the relationship between sulfur dioxide emissions and per capita gross regional product (GRP) is N shaped with multiple limits.

The study also found that increasing direct foreign investment inflows to China would reduce sulfur dioxide emissions. In addition, trade plays an important negative role concerning sulfur dioxide emissions; and counties with a higher ratio of secondary industries' output to GRP generate larger quantities of sulfur dioxide emissions. On the other hand, complementary investment for treating industrial pollution in the private sector can effectively reduce sulfur dioxide emissions. The spatial autocorrelation coefficient was found statistically positive thus proving the existence of a positive spatial correlation (and spatial competition as well) of sulfur dioxide emissions between the different counties in China.

Previous studies had tackled that subject, such as **Islam, A. M. and Lopez, R. E., 2014**.

It is noteworthy that some of these results can be applied to Egypt. An adequate investment climate can incentivize direct foreign investment to establish complementary industries in order to reduce the industrial pollution resulting from private sector activities.

The study of **Wu et al., 2019** analyzed the causal relationship and co-integration between environmental pollution (per capita share of carbon dioxide emissions) and health care expenditure, while taking into consideration economic growth as a control variable and applying *Wavelet analysis* to Taiwan during the period 1995-2016. Results confirmed the existence of a causal relationship and co-integration between environmental pollution and health care expenditure at different times and frequencies. Changes in the relationship between

the two variables were noticed and related to certain events such as the expansionary stage period, the environmental pollution policy, the issuance of the national health insurance integrated circuit (NHI-IC) card. Wavelet analysis was moreover found useful for assessing the impacts of the different social and economic scenarios within the framework of the changing environmental and health care policies in Taiwan. Hence a positive causal relationship was found in the short run between health care expenditure and the environment, during the expansionary or economic development stage. However, in the long run, the causal relationship between health care expenditure and the environment was found negative. Therefore, governments should consider the environment as a public good of prime concern when meeting the demand for other public goods.

The reform of the Chinese economy during the last forty years and the adoption of the open-door policy led to a rapid economic development. However that speedy boosting of the Chinese economy entailed higher air pollution. In order to control air pollution in urban regions in an effective way, Chinese governments at all levels kept spending large amounts of money every year. Nonetheless the pollution problem remained a critical concern influencing the general policy of the country regarding the challenge how to improve air quality while saving money at the same time.

The study of **Xie. X. and Wang, Y., 2018** took Beijing as an example for investigating the changes in the daily average quantities of inhalable particle matter (PM_{10}), sulfur dioxide and nitrogen dioxide over a ten-year time period, extending from 2006 to 2015. A relationship was established between the atmosphere indexes of the three above-mentioned pollutants (as parameters) and the funds invested by the government on environment protection. The results of the model showed that the financial inputs disbursed by the government had an obvious impact on air quality improvement in the short run. However in the long run, with increasing financial inflows, the rate of air quality improvement will gradually decrease. A direct relationship was also found between the effectiveness of government financial inputs for enhancing air quality and the air quality index. This means that in order to provide the best conditions for the national ambient air quality improvement, the government should determine its detailed financial inputs at or above the level of the primary standards, according to air quality criteria in urban regions.

In the study of **Chang, C-P. et al., 2019**, the researchers used the panel fixed-effect regression model to investigate the impact of the environmental governance (expressed as the ratio of government expenditure on environment protection to gross domestic product GDP) on environmental conditions (expressed as carbon dioxide emissions, energy density, and the environmental performance index). The study sample included eighteen Asian countries and twenty-six European countries. The study revealed a significant positive effect of the environmental governance on environmental quality improvement in the group of Asian countries.

The concepts of the green growth economy and the green economy aroused a great deal of interest around the world. Moreover, the green economy has been considered an effective instrument for reducing environmental degradation, economizing resources, and even boosting economic growth (**Musango et al., 2014**). Several studies and organizations presented a clear definition of the green economy. (See for instance: UNEP, 2011; FAY, 2012; Jänicke, 2012); while some international institutions adopted the green economy as a unique strategic concept (OECD, 2009; UNEP, 2011).

On the other hand, **Schmalensee, 2012** presented a critical overview of the concept definition and of the main impacts of the green economy.

Loiseau et al, 2016 determined for the first time the characteristics and dimensions of the green economy through using the *bibliometric analysis*. Then they assessed the relationship between the green economy and sustainability.

Actually, various studies focused on the green growth economy. Hence **Musango et al., 2014** reached the conclusion that moving towards the green economy may reduce harmful emissions and save natural resources.

Reilly, 2012 deduced that economic growth, environment protection and the creation of job opportunities are the three purposes of the green economy.

Bagheri et al., 2018 depended on analyzing energy inputs and outputs in order to trace the potential course of the green economy under various situations in Canada.

Other recent studies also investigated the impact of the green growth.

Ma et al., 2019 assessed the efficiency of the green growth in two hundred and eighty-five Chinese cities. **Yang et al., 2019** discussed the different impacts of green development in several Chinese cities in which the economy has been mainly depending on natural resources.

Moreover, numerous studies explored the motives behind the adoption of a green growth policy. **Yi and Liu, 2015** measured the green economy growth at the city level in China, and analyzed changes in the population, education levels and other social and economic factors in order to explain the variability of the green growth impacts.

Lin and Benjamin, 2017 established a green growth index for thirty counties in China, using the *NDDF method*. Then they adopted the quantitative approach and investigated the impact of changing the best practices gap, the technology gap and efficiency levels on green growth. **Li, Xu, 2018** explored the impact of natural resources abundance on green growth, based on city level data in China. Li warned against the ‘curse of resources’ meaning that regions enjoying an abundance of natural resources tend to suffer more from environmental degradation. **Pan et al., 2019** depended on panel data of Chinese counties to calculate the index of a low carbon economy, using the *directional distance function*. Then they analyzed the factors influencing that index through applying the *panel vector auto-regression model* to the panel data.

Qin et al., 2019 discussed major factors influencing green growth within the framework of the iron and steel industry in China. **Wu et al., 2019** revealed the impact of the electricity replacement policy on the green growth economy in China.

On the other hand, only a few studies tackled the relationship between financial instruments or spending on research and development and their impact on the green economy. **Wang and Shao, 2019** noticed that total expenditure on education, as well as expenditure on research and development, had a positive impact on green growth. **Dulal et al., 2015** analyzed the role of financial instruments in the Asian evolution towards the green economy. The researchers discovered that the adoption of new financial instruments was too slow and insufficient to bring about the desired evolution. They also underscored that different countries needed to adopt different kinds of financial instruments.

The relationship between financial expenditure and the growth of the green economy was also analyzed by **Lin, B. and Zu, J., 2019**. The

researchers established an index for the green economy growth through applying the *non-radial direction distance function*. Then they used the *GMM* (generalized method of moments estimation) to assess the impact of expenditure on education and scientific research on the green growth. They mainly concluded that financial expenditure on research and development and on education does have a boosting effect on the green growth through first, technological activities and second, human capital-intensive activities. It is noteworthy that such activities may also have outstanding roles in various fields.

Studies tackling the role of the government towards achieving environmental sustainability were classified under two headings as follows:

1. The influence of ideology and political trust in arousing public support for government policies aiming at environment protection

It has become increasingly obvious that environmental problems – such as the changing climate and global warning¹ resulting from the trapped greenhouse gases phenomenon² - represent challenges that are threatening the very existence of human communities. Furthermore, these problems will probably continue and even get worse, unless governments devise effective and costly environmental policies. In order to embark on such endeavors, governments eventually will need their peoples' support. Although the global society has yet to confront wide-reaching environmental problems, such as global warning and trapped greenhouse gases, there are still large differences between various societies concerning environmental performance and government expenditure in this respect. (See for instance: **Emerson et al., 2010**; and **Hsu and Zomer, 2016**). In the relevant literature, a pivotal role is often attributed to governments regarding environment protection, either for the implementation of policies with direct impact on environment protection or for solving the problems of collective environmental activities (**Mansbridge, 2014**).

¹ According to the IPCC, a subsidiary organization of the United Nations, there is a steady slow increase in the average temperature of the Earth's atmosphere, known as the global warning phenomenon.

² Meaning the rising ratios of primary gases (CO₂, CH₄, CFCs, N₂O, H₂O) in the Earth's atmosphere thus increasing temperatures and causing global warning.

To exert greater efforts for environment protection, governments will eventually rely on people's support. An unstable support from citizens would impose serious restrictions on governments' aspirations to provide favorable conditions for the implementation of effective and costly environmental policies. Therefore, it is quite important for governments to understand the complete process for obtaining citizens' support for environmental policies.

Public support for environmental policies depends on citizens' belief that environmental protection is first and foremost the government's responsibility and necessitates government policies and expenditure. However the translation of such beliefs into concrete political opinions cannot take place in a social and institutional void. Actually, an increasing number of studies are proving that environmental beliefs and values are way off from being always translated to corresponding political behaviors and positions (**Kollmuss and Agyeman, 2002**). Besides, wide differences exist between countries in this concern (**Pisano and Lubell, 2017; Tam and Shan, 2018**). Previous studies have established certain determinants of environmental positions at the individual level, such as basic convictions and values (**Dietz et al., 1998; Stern and Dietz, 1994**). This means that behavioral factors and individuals' convictions play a decisive role in shaping citizens' positions towards environmental protection policies. Moreover, numerous studies revealed that environmental issues, such as climate change, have become increasingly politicized in western countries. (See for example: **Carter, 2014; McCright et al., 2011**). Although historically, public support for government expenditure on the environment had been separate from the traditional political differences of opinion (**Jacoby and William, 1994**).

Recent studies, particularly in the United States, show that expenditure priorities are becoming more and more polarized on political party bases. Left-wing or liberal citizens will probably support environmental expenditure, in comparison to those who hold right-wing or conservative views (**McCright et al., 2014**). Moreover, researches concerned with positions toward environmental taxes – such as taxes on fossil fuel—reveal that the role of the government regarding general environment protection is politically polarized and closely related to the prevailing political ideology (See: **Fairbrother, 2016; Konisky et al, 2008; Haring and Jagers, 2013; Haring et al., 2017**).

Actually, the importance of political ideologies has been a recurrent subject in the environment related literature; as it seems probable that liberals and left-wing proponents would lend all kinds of support to the government's efforts toward environment protection (**Dunlap, 1975; Dunlap et al., 2001**).

These results are compatible with findings of wider-scope studies exploring different points of view concerning the responsibilities of the government at large. Those later studies similarly conclude that left-wing parties will be relatively more supportive toward governmental intervention via imposing new taxes and spending public funds on a large array of fields, such as social welfare and the labor market. (See for instance: **Jaeger, 2006; Feldman and Zaller, 1992**)

However, most of the studies investigating the impact of ideological orientations on positions concerning environmental issues are focused on the individuals' self-determined political preferences, and their self-positioning on a continuous chain, extending from the views of the far left-wing party to those of the far right-wing party. (For an overview, see: **Harring et al., 2017**).

Although it is often assumed that political ideologies, expressed as different self-determined left-wing or right-wing positions, include distinctive standard opinions regarding the size and scope of government intervention. (See for instance: **Inglehart and Klingemann, 1976; Lipset and Rokkan, 1967**)

Only very few studies shed the light on the direct relationship between the environmental policy and ideological orientations and explicitly analyzed the government role in environment protection. Meanwhile numerous researchers argue that individuals' self-positioning on a continuous chain extending from the far left political position to the far right political position is a dubious representation of political ideologies, as 'left' and 'right' are unclear classifications lacking consistent and objective meanings valid across times and places (**Knutsen, 1998; Kumlin, 2004**). Therefore surveying individuals' opinions based on their self-determined position between 'left' and 'right' can be quite problematic. Seeking individuals' standard opinions concerning the government's responsibility toward environmental protection thus seems an advantageous procedure.

Previous studies revealed large differences between countries concerning citizens' support for government expenditure on the environment (**Rasinski et al., 1994**). Many studies revolving around

the ideological factor and using various measures in that respect, found that the ideological impact on environmental positions was probably stronger in some countries than in others. (See: **Fairbrother, 2016; McCright et al., 2016; Tesler, 2018**).

Most likely, the impact of standard opinions concerning the government's role will similarly differ from one country to another. In fact, numerous studies revealed that people's support for environmental policies depends to a great extent on citizens' trust in politicians and the political system. Certain studies found for instance that citizens' support for environmental taxes was stronger in the countries enjoying high levels of political trust. (**Fairbrother, 2016; Harring and Jaegers, 2013; Kollmann and Reichl, 2015**)

The above-mentioned conclusions confirm more general research findings concerning political standpoints as political trust was revealed a vital factor for the support of government policies. (See for example: **Rudolph and Evans, 2005**). Political trust means that citizens are convinced that politicians will not act in an irresponsible way; for example, citizens who trust their government would be ready to lend their support to the government's management of tax payers' contributions. (**Hetherington, 2005**). Some studies proved that political trust at the State level has a significant impact on political positions (**Fairbrother, 2016**). Other studies insist that actual trust worthiness and the efficiency of politicians and the political system are major factors for gaining support for the State policies (**Levi and Stoker, 2000**).

On the other hand, cross-country studies have largely neglected the role of legal and bureaucratic institutions in charge of the preparation and implementation of government policies. In other words, although political trust is deemed a crucial factor for backing-up environmental taxes (carbon taxes, for example), citizens' support for government expenditure on the implementation of environmental policies should rely more on the characteristics of the government institutions in charge of such implementation. In a recent contribution (**Arpad, 2018**), the researcher argues that citizens' trust in the government's ability to successfully implement such policies greatly influences their readiness to support public expenditure on environmental policies. Arpad did investigate individuals' trust in the policy implementing government institutions; however it is not clear whether differences in individuals' support for government expenditure reflect mere self-judgment and

personal opinions or objective standpoints based on the actual performance of these institutions.

2. The impact of government quality and actual institutional performance on environmental protection

In the literature on *rational governance*, the quality of the government is increasingly in focus. According to this perspective, a high-quality government has the advantage of functioning through unbiased, just and effective institutions, practicing their authority without corruption (Holmberg et al., 2009; Rothstein, 2011). Hence these institutions represent the ‘output’ side of the political system, including all the governing system, from legal institutions to the police, the bureaucratic system and government officers.

However, in the literature on the theory of democracy, a debate was aroused regarding the importance of distinguishing between the institutions which practice government authority (QOG) and other democratic institutions (such as legislative entities); whereas empirical evidence increasingly reveals that the relationship between legislative entities and executive institutions is weak. Thus the quality of the government may be considered a unique feature of the political system (Rothstein, 2011). Furthermore, the quality of government has been linked to many desirable economic and social aspects, such as economic flourishing, favorable public health conditions, and environmental sustainability. (See: Holmberg et al., 2009).

On the other hand, findings concerning environmental sustainability have been controversial. Some studies showed a relationship between government corruption levels and low levels of environmental sustainability on the index established by the researchers (Morse, 2006). Meanwhile other studies found the opposite relationship between corruption and the environmental footprint index (Ewers and Smith, 2007). Those results are not surprising as the two above-mentioned indexes rely on widely different concepts of environmental sustainability (Bohringer and Jochem, 2007). Consequently, the quality of government institutions may have different impacts on the specific aspects of environmental sustainability under study; for instance improving local environmental conditions versus reducing the global carbon footprint. Therefore, it appears that the basic mechanism relating the quality of government institutions to environmental sustainability (and other favorable environmental

outcomes) has not yet been conceptualized and is still experimentally undiscovered.

Among important methods to investigate the relationship between the quality of government and environmental policies that are favorable for the society is measuring the relationship between various environmental sustainability indexes and people's support for the environmental policy. Previous studies revealed that some aspects of the high-quality government – such as absence of corruption – were positively related to individuals' preparedness to bear economic sacrifices in view of environment protection (**Harring, 2013**). General perceptions of the effectiveness of the environmental policy tools was even a more positive factor (**Harring, 2014**); (**Harring, 2016**). Although corruption represents only a limited conception of the quality of government (**Rothstein, 2011**), the results of the afore-mentioned studies indicate that the quality of government factor - as expressed by the corruption index - could still have an important impact on people's support for government expenditure on the environment.

Certain previous studies also related government expenditure on other domains to the quality of government. **Rothstein, 2011** concluded that the expenditure levels of the welfare State were obviously related to the quality of government. This result shows that public support for government expenditure in general increases with the improvement of the quality of government. Moreover, in the study of **Svallfors, 2013**, the researcher analyzed the impact of the perceived quality of government on social expenditure preferences. He found that individuals' general perceptions concerning the quality of government did not only have a direct impact on the support for government expenditure, but that such perceptions also reduced the effect of standard (ideological) standpoints concerning individuals' preferences regarding social expenditure. We deduce that the quality of government is a potential decisive intermediary in the relationship between basic standard (ideological) viewpoints and concrete expenditure preferences.

One of the most important recent studies in this respect is that of **Kulin, J. and Johansson, I., 2019**. In that study, the researchers analyzed the government role in environment protection via studying the quality of government and surveying individuals' preferences concerning government's responsibility for spending on environment protection. They used the software for *multilevel analysis (MLA)*, the *QoG model and the International Social Survey Programme (ISSP)*

to obtain data at the individual level concerning the study variables. They concluded that the quality of government had a general positive impact – through its indirect effect on standard viewpoints at the individual level – on the public support for government expenditure on environment protection.

Wen, J. et al., 2016 carried out an empirical study using aggregate multi-national data from eighty-five countries for the time period (2002 – 2012). The researchers investigated the relationship between the government ideology and environment quality, through the application of the *LSDVC technique* and using a number of comprehensive environment quality indexes, such as: EPI, EHI, EVI. The researchers studied the potential indirect impact of the ideology (through integrating various ideology indexes) on environmental performance via the ideology impact on economic development.

Finally the researchers investigated the specific position of political parties in coalition governments, as well as the reasonable role of democratic parties in shaping environmental standpoints. They concluded that generally speaking, left-wing governments prefer environment quality improvement to economic growth; while right-wing governments are more interested in economic growth than in environmental issues. However when exposed to pressures for a better economic performance, both left-wing and right-wing governments tend to abandon environmental goals for the sake of achieving a higher economic growth rates. That study also revealed that parties classified as supportive of the ‘anti-growth economy’ and environment protection achieve a better environmental performance; and that democratic parties tend to promote environment-friendly policies in the Organization for Economic Cooperation and Development (OECD) member countries.

From previous studies, it appears that government expenditure on environment protection requires two main pillars: Firstly, citizens’ political trust in their government; and secondly, the good quality of government and actual institutional performance. These two interacting elements positively impact not only citizens’ support for government expenditure, but also strongly tend to orient standard (ideological) standpoints in that same direction.

3. The study variables and model description

The applied section of the present study aims at measuring the impact of government expenditure on environmental performance in

Egypt. Toward this end, the study relied on the data of annual time series during the period (1990 – 2017) in Egypt with a total of 26 observations. The data were outsourced from various international and national organizations, such as the World Bank, the International Monetary Fund (IMF), UN and the Egyptian Ministry of Finance. The study sample was chosen based on the available data.

Given that some indexes concentrate on only one aspect of environmental performance such as carbon dioxide emissions or other air pollutants, this study relied on composite indexes to investigate environmental performance in Egypt from two perspectives: Weak environmental sustainability and strong environmental sustainability.

(2-1) 3.1. Environmental Performance (Environmental Sustainability)

3.1.1. Weak environmental sustainability

The *Genuine Wealth per capita (GWC) index* used in this study is a widely known and precise indicator for measuring weak environmental sustainability. Genuine wealth (or genuine saving, also known as adjusted net saving) is an indicator of an economy's underlying capital stocks. Wealth, when measured in detail, accounts for the assets, such as natural capital, produced capital and human capital that underpin production and consumption possibilities, and in this way, shows us viable development pathways.

Clearly, the Genuine Wealth indicator covers a wider scope than the traditional net saving concept which concentrates on changes in productive assets only. Negative rates of genuine saving implicitly show that an economy's wealth is decreasing and that the current policies generating such negative rates are not sustainable; and vice-versa, i.e., rising rates of genuine saving would indicate sustainable development policies.

The genuine saving index has also the advantage of presenting environment and resources issues in an understandable way to the ministries of planning, finance, development and other concerned entities.

The genuine saving index can be calculated according to the following formula.

Genuine saving = Net national saving* + Current operating expenditure on education as a measure of investment in human capital – (value of the depletion of natural resources such as energy and minerals, and the net value of forests' depletion + the damage resulting

from pollution including carbon dioxide and inhalable particle matter emissions and similar pollutants)

*Net national saving = Gross national saving – fixed capital depreciation

3.1.2. Strong environmental sustainability

This study used the per capita ecological surplus/deficit index to express strong environmental sustainability. This well-known indicator measures the impact of a given community on Planet Earth and its natural systems. It aims at describing to what extent the lifestyle of the inhabitants of a specific country is sustainable and to what extent these people affect or damage Planet Earth. In order to obtain these results the country's net consumption of natural resources (agricultural lands, pastures, constructions, forests and fisheries) – known as the ecological footprint- is compared to the country's capacity to reproduce such natural resources and to absorb the wastes resulting from their consumption. This is known as the country's *biocapacity*. In other words, human demand (footprint) is compared to the supply of nature (capacity) in the same way that demand is compared to supply, or expenditure is compared to income in economic accounts.

Ideally speaking, the ecological footprint of a country would be equal to its biocapacity so as to maintain equilibrium. But when the footprint is greater than the biocapacity (i.e., the case of a negative difference), the country would be suffering from an ecological deficit, which means that its inhabitants are using natural resources and polluting the environment at a higher rate than the natural environmental system's capacity to renew them; and vice versa.

3.2. Government expenditure

The independent variable in this study is the *per capita total government expenditure index*. However using the total expenditure index may expose us to the problem of the 'aggregation error' entailed by the use of highly aggregated data – such as income, expenditure or consumption indexes. Aggregation shields some of the distinctive characteristics of the behavior of sample observations. For instance, when calculating total government expenditure, we need to aggregate a large group of subsidiary expenditures related to various economic and social purposes. In doing so, we lose sight of important characteristics and determinants concerning the behavior of subsidiary expenditures, such as the declining trend of investments in contrast to the rising trend of other fields of government expenditure. Therefore, in order to avoid

the aggregation problem, we shall take into account some of the subsidiary expenditures that are the most closely related to environmental sustainability, namely: *Investment, social protection, health care, and environment protection taken at the per capita level.*

3.3. Formulation of the study general model

The economic theory states that environmental sustainability is a function of three main factors, namely:

- **Institutions governing the allocation of resources:** This factor represents an essential pillar and an important dimension for the realization of environmental sustainability. Efficient institutions are solely capable of planning, designing and implementing sustainable economic and environmental policies. As a matter of fact, several studies inferred that many countries have been unable to realize environmental sustainability because they lack efficient institutions and rational governance.

- **The production base of the economy (capital investment):** In any country, capital and production base are the feeding injections for obtaining environmental sustainability (increasing genuine wealth). The production base of any economy includes its human wealth, the size of total investments, total output, equitability of output distribution, and other elements which together make up the genuine wealth of the country and basically represent the main differences between countries in this respect. For example, if a country is realizing high output levels, we can expect it to generate high income levels and consequently high savings levels; and vice-versa.

- **Shadow prices of the country's natural resources:**

Shadow prices reflect the scarcity of the country's natural resources. They also express, contrary to the production base, the factors causing leakages from a country's genuine wealth; that is, the factors leading to the reduction of a country's genuine wealth. For example, the increasing expenditure on armament in some developing countries which rely on the income generated by selling natural resources, such as the Arab Gulf countries which depend on oil revenues, entails the depletion of the available foreign currency funds. This in turn leads to an increasing depletion of natural resources in order to compensate for the leakage in foreign currency funds. Thus the country's natural resources are exploited in an unsustainable way.

Based on the above-mentioned analysis, we may devise the econometric model of this study as follows:

$$GW_{cit} = \beta_{i0} + \beta_1 INSTITUTIONS_{it} + \beta_2 STOCKS_{it} + \beta_3 SHADOW_{it} + \varepsilon_{it}$$

In this model, the country's institutions and production base and shadow prices represent the three principal control variables, as suggested by the economic theory. For expressing these main categories, this study relied on the study of **Aidt, 2010**, as follows:

INSTITUTIONS: This variable stands for economic, political, and legal institutions that control the allocation of natural resources. It was calculated by using the Transparency (low corruption) index and the Quality of Government (bureaucratic efficiency) index. According to the economic theory, in a country enjoying high transparency and government efficiency levels, the government would be expected to adopt adequate economic and distributional policies that foster the realization of environmental sustainability for the whole society; and vice versa.

STOCKS: This variable denotes the production base. However, given the small number of observations available for this study, the Human Development Index (HDI) was used. The **Human Development Index** is composed of the average number of study years index; the expected average number of study years index; the life expectancy at birth index; and per capita gross national product (GNP). Therefore, this index is considered the best compound index for this study, as it includes in a single number the three major dimensions of human development, namely: Health, education and per capita income. Hence this index provides the degrees of freedom necessary to maintain the efficiency of the study model. Higher levels of human development are expected to generate higher levels of production and income, and entail higher savings levels.

SHADOW: Shadow prices (accounting prices) were represented by the openness (to international trade) index expressed by the expenditure on imports of goods and services as a ratio of gross domestic product (GDP). According to the economic theory, a high ratio of imports (*Imports*) in a developing country like Egypt means that hard currency funds are being depleted and consequently natural resources are also being depleted at an unsustainable rate in order to provide the necessary foreign currency funds required for the imports.

The principal model of the present study has been accordingly formulated to investigate the relationship in Egypt between

government expenditure and the level of environmental sustainability, using the logarithmic form, as follows:

$$\ln EV_t = \beta_0 + \beta_1 \ln Gov.Exp_t + \beta_2 \ln Corruption_t + \beta_3 \ln Efficiency_t + \beta_4 \ln HDI_t + \beta_5 \ln Imports_t + u_t$$

Where EV (Environmental sustainability) is the dependent variable; the targeted variable is $Gov. Exp.$ which represents per capita general Government Expenditure (or the used subsidiary component thereof); whereas $B_{2,3,4,5}$ represent the coefficient vector of the control economic variables used in this model; t is the time period of the study (1990-2015); B_0 is the constant; and u is the error term. The logarithmic form was used to overcome some of the measurement problems and to reduce data dispersion, in addition to obtaining the long-run flexibilities of the variables.

4. Econometric analysis and empirical results

For the present study, time series were analyzed and the long-run dynamic impact of the relationship between government expenditure and environmental sustainability in Egypt was investigated. The study depended on co-integration using the *Bounds Testing Approach* which in turn depends on using the *Autoregressive Distributed Lag (ARDL) model*.

The study variables were then tested to make sure they were stationary and did not exceed the first difference. In addition, various diagnostic tests were used to check the validity of the analysis models and the absence of measurement problems in them. Based on the results of those tests, we were able to verify the validity of the models for investigating both the short run and the long run relationships under study.

In the following sections, the results of the empirical models are presented regarding both weak sustainability and strong sustainability aspects.

4.1. Weak sustainability econometric results of the ARDL model

From Tables (1), (2), (3), and (4), it can be seen that the error correction coefficient [ECM (-1)] has a significant and negative value in most models. This means that the correction mechanism exists in those models denoting the relationship stability in the long run.

The results of Table (1) show that government expenditure and most of its subsidiary components had a negative effect on

environmental sustainability in Egypt. This finding can be explained as follows:

The results of the first model show that per capita total government expenditure had a negative impact on per capita wealth in the long run.

The estimator value equaled 0.8419 which means that an increase of one unit in per capita government expenditure leads to a reduction of 0.842 in per capita wealth.

Although this finding may contradict certain economic schools of thought, it was in fact expected because the structure of public expenditure in Egypt does not support the realization of a positive change in genuine wealth per capita. Hence approximately one-third of public expenditure goes to debt repayment and debt service, thus representing what the current generations have to bear for what previous generations have consumed. Moreover, about two-thirds of public expenditure in Egypt goes to paying the salaries of the expanded public sector and settling the bill of subsidies. The remaining part of approximately 10% is used to cover all the other requirements including health care, education, scientific research, investments, etc. It is obvious that the three main categories of public expenditure (public debt repayment, salaries and subsidies) do not help in any way the realization of environmental sustainability; whereas the other fields which could actually promote environmental sustainability receive only a minor ratio of public expenditure and therefore they have no influence in this respect.

This deduction is backed up by the results of our analysis concerning the impact of the remaining items of public expenditure on per capita genuine wealth. Thus, we find a negative impact of per capita investment expenditure in the second model; and of per capita public expenditure on subsidies in the third model; and of per capita public expenditure on health care in the fourth model, on per capita genuine wealth in Egypt.

It is quite logical that public expenditure on subsidies would have a negative impact on genuine wealth since subsidies entail increased consumption of goods and increased depletion of resources; and in any case, subsidies mostly benefit limited income classes who have a very low propensity to save and therefore cannot have a positive impact on wealth. On the other hand, the negative impact of investment and health care expenditure may seem illogical from a theoretical point of view; since investment is expected to increase production, income and

savings. Similarly, health care expenditure is supposed to preserve the good health of citizens and workers who represent the human wealth of any society and form part of a country's genuine wealth. **See Table (1).**

The negative impact of investment expenditure may be explained by the tendency of the State to abandon the establishment of new projects (through the public business sector) and to limit itself to spending on the renewal and replacement of the existing projects (capital depreciation). At the same time, only small amounts are spent on providing a good infrastructure base which would boost the activity of various economic sectors and especially the industrial sector. Regarding the negative impact of public expenditure on health care – a finding confirmed by previous studies such as that of *Wu et al., 2019* – it may be inferred to the fact that most of that amount is spent on the wages and salaries of workers and staff employed in the public health sector; while no efforts are being exerted to improve the currently provided health care services although they have deteriorated to a poor level. Furthermore, public expenditure on health care services did not increase in conformity with the increasing rate of general government expenditure; although the latest Constitution in Egypt provides that the State shall allocate a ratio of not less than 3% of its gross national product to health care and that ratio shall be gradually increased to reach international standards. However, even that minimum ratio has not been realized.

Table (1): Government Expenditure and Total Genuine Wealth per capita in Egypt

<i>Dependent Variable</i>	<i>Reg (1)</i> <i>ln GWc</i>	<i>Reg (2)</i> <i>ln GWc</i>	<i>Reg (3)</i> <i>ln GWc</i>	<i>Reg (4)</i> <i>ln GWc</i>	<i>Reg (5)</i> <i>ln GWc</i>
Long-run coefficients:					
<i>ln General Gov. Exp.</i>	-0.8419 (-2.617)**				
<i>ln Investment Gov. Exp.</i>		-2.6486 (-3.819)**			
<i>ln Subsidies Gov. Exp.</i>			-1.3327 (-5.666)***		
<i>ln Health Gov. Exp.</i>				-1.9314 (-6.559)***	
<i>ln Environment Gov. Exp.</i>					0.1244 (1.201)
<i>ln Corruption</i>	-0.6596 (-2.411)**	-1.8889 (-3.790)**	-0.3105 (1.483)	-1.7427 (-6.128)***	-0.0356 (-0.169)
<i>ln Efficiency</i>	1.6834 (4.661)***	6.0401 (4.185)**	2.0054 (7.935)***	2.0249 (7.522)***	2.2121 (4.777)***
<i>ln HDI</i>	6.6693 (2.340)**	20.274 (3.729)**	8.9359 (5.158)***	17.427 (6.402)***	-2.0424 (-1.587)
<i>ln Imports</i>	-0.9272 (-2.600)**	-1.4191 (-3.139)**	-2.3354 (-7.261)***	-1.7633 (-4.074)***	-2.1892 (-4.128)***
<i>Const</i>	10.842 (2.961)**	15.062 (4.725)**	17.032 (8.184)***	19.407 (9.212)***	2.5131 (1.298)
Error correction coefficient					
Φ_i	-1.1424 (-6.150)***	-1.0542 (-4.449)***	-1.6577 (-10.09)***	-1.4498 (-19.29)***	-1.0002 (-9.375)***
Short-run coefficients:					
<i>ln GW per capita(-1)</i>	-1.1424 (-6.150)***	-1.0542 (-4.449)***	-1.6577 (-10.09)***	-1.4498 (-9.797)***	-1.0002 (-6.107)***
<i>ln Gov. Exp.</i>	-0.9618 (-2.539)**	-2.7921 (-7.321)***	-2.2093 (-7.321)***	-2.8001 (-6.909)***	0.1245 (1.265)
Selected lag Model:	(2, 2, 2, 2, 1, 2)	(3, 2, 2, 2, 2, 2)	(1, 0, 2, 0, 0, 0)	(2, 1, 2, 2, 2, 2)	(1, 0, 2, 1, 0, 0)
ARDL Bounds test:	27.421***	24.541***	4.4382**	26.589***	8.5908***
Adjusted R-squared	0.9247	0.9461	0.6328	0.9253	0.6991
Fisher test (<i>F-stat.</i>)	(17.111)***	(21.461)***	(5.7393)***	(18.042)***	(6.6786)***

Note: - ***, **, * indicate significance at 1%, 5% and 10% respectively.

Finally, the fifth model revealed the absence of a relationship between per capita public expenditure on environment protection and per capita genuine wealth. This result indicates that in Egypt, the impact of public expenditure on the other components of genuine wealth, such as the depletion of resources, savings and education, is greater than its impact on pollution; and consequently public

expenditure on environment protection has no impact on per capita genuine wealth.

On the other hand, the study results concerning all the control variables were compatible with the economic theory and the expected trends. Hence the results of all the models, with the exception of the fifth model, show that government efficiency and human development had a positive impact on per capita wealth. It is also noteworthy that human development had the greatest impact on per capita genuine wealth which is logical since efficiently educated and trained human resources are considered an important part of any country's genuine wealth. Similarly, effective institutional abilities represent a crucial factor for realizing sustainable development in any country.

Corruption not only distorts the economic process of any country, it also ruins government institutions which represent the main pillar for devising and imposing favorable policies aiming at the realization of environmental sustainability. Imports cause the depletion of the country's hard currency funds and encourage the State to exploit its natural resources - such as oil and natural gas – at high rates to cater to its hard currency needs; moreover, the opportunity cost of these resources is foregone for the country. All this eventually leads to the reduction of genuine wealth or genuine savings in Egypt.

Key regression statistics show a high value of the adjusted coefficient of determination [adjusted R^2 indicating that the study models explain 63% to 94% of the changes occurring in total genuine wealth per capita in Egypt. In addition, the Durbin-Watson statistic is stable around 2, confirming the absence of a serial correlation between residuals. Fisher test (F-statistic) further underscores the refusal of the null hypothesis and acceptance of the alternative hypothesis affirming the significance of the used models as a whole at the 1% level.

In order to obtain logical interpretations of the negative impact of the public government expenditure and some of its subdivisions on environmental sustainability, the impact of total government expenditure on the components of genuine wealth in Egypt was measured. **See Table (2)**

Table (2): Government Expenditure and sub-component genuine wealth per capita in Egypt:

<i>Dependent Variable</i>	<i>Reg (6)</i> <i>ln Net Saving</i>	<i>Reg (7)</i> <i>ln Education</i>	<i>Reg (8)</i> <i>ln Energy</i>	<i>Reg (9)</i> <i>ln Minerals</i>	<i>Reg (10)</i> <i>ln Forest</i>	<i>Reg (12)</i> <i>ln Particles</i>
Long-run coefficients						
<i>ln General Gov. Exp.</i>	-0.2085 (-2.012)	2.9171 (0.035)	0.9109 (12.37)***	2.0965 (2.703)**	1.3570 (22.96)***	0.6924 (2.163)**
<i>ln Corruption</i>	-0.2971 (-3.411)**	65.539 (0.033)	-0.0262 (0.420)	-2.7234 (-2.165)*	0.2029 (3.224)**	-0.9607 (-1.506)
<i>ln Efficiency</i>	1.2701 (5.733)**	-35.815 (-0.032)	0.0614 (70.453)	3.8693 (1.285)	-0.7411 (-10.11)***	1.4643 (1.701)
<i>ln HDI</i>	4.7083 (5.159)**	-106.03 (-0.032)	-1.0415 (-1.463)	12.401 (1.369)	-6.0999 (-10.65)***	-0.5832 (-0.147)
<i>ln Imports</i>	-0.1153 (-0.531)	-71.294 (-0.033)	1.2936 (5.899)***	-2.3355 (-1.203)	0.4111 (3.353)**	-0.5309 (-1.235)
<i>Const</i>	4.6812 (4.609)**	323.94 (0.033)	-7.3429 (-8.722)***	-17.687 (-1.734)	-9.7524 (-15.86)***	-7.5997 (-2.104)*
Error correction coefficient						
Φ_i	-1.2475 (-8.051)***	0.0045 (0.033)	-2.6357 (-8.944)***	-1.0601 (-1.930)	-1.9503 (-19.34)***	-0.2035 (-1.824)*
Short-run coefficients:						
<i>ln GW per capita(-1)</i>	-1.2475 (-8.051)***	0.0045 (0.033)	-2.6357 (-8.944)***	-1.0601 (-1.930)	-1.9503 (-19.34)***	-0.2035 (-1.824)*
<i>ln General Gov. Exp.</i>	-0.2601 (-2.166)	-0.0132 (-0.103)	2.4008 (6.211)***	2.2225 (1.399)	2.6467 (13.51)***	0.1409 (1.201)
Selected lag Model:	(3, 2, 2, 2, 2, 2)	(1, 0, 0, 2, 0, 0)	(3, 2, 2, 2, 2, 2)	(3, 2, 1, 0, 2, 2)	(3, 2, 2, 2, 2, 2)	(1, 0, 1, 0, 0, 0)
ARDL Bounds test:	37.290***	4.2755**	27.937***	5.5609***	133.58***	9.7279***
Adjusted R-squared	0.9827	0.9835	0.9906	0.9628	0.9970	0.9697
Fisher test (<i>F-stat.</i>)	(67.331)***	(164.95)***	(125.50)***	(37.193)***	(392.90)***	(106.29)***

Note: - ***, **, * indicate significance at 1%, 5% and 10% respectively.

The results of Table (2) shed the light on the reasons behind the negative impact of total government expenditure and most of its subdivisions on total genuine wealth per capita in Egypt. Actually these results indicate that total government expenditure in Egypt does not influence the components which may increase genuine wealth, namely net savings and education, as apparent from the sixth and seventh models. In other words, government expenditure in Egypt does not promote policies and investment activities that lead to increased production and increased savings. As above-mentioned in the analysis of Table(1), most of the public expenditure funds are allocated in large part to public debt servicing, wages and salaries and subsidizing food products and other necessities. Furthermore, expenditure on education is not correlated to the annual growth rate of total government expenditure; although the latest Constitution in Egypt provides that at least 4% of gross national product shall be spent on education and that this ratio shall be gradually increased to reach international standards. However the State has not abided by those provisions and that explains the absence of a correlation between total government expenditure and expenditure on education in the seventh model.

Similarly total government expenditure has no impact on the damage resulting from carbon dioxide emissions which represent the major ratio of air pollution, as revealed by the absence of a correlation between the variables of the eleventh model. This finding explains the absence of a relationship between government expenditure on environment protection and genuine wealth per capita in the fifth model.

The negative impact of government expenditure on environmental sustainability in Egypt betrays the positive relationship between government expenditure and the depletion of resources of all kinds (energy, minerals and forests) which are deducted from the stock of genuine wealth per capita, as deduced from the eighth, ninth and tenth models. Moreover, there is a positive relationship between government expenditure and the damage resulting from particle emissions which represent a minor ratio of air pollution, as shown in the twelfth model.

Briefly increasing government expenditure in Egypt leads to increasing the depletion of natural resources of all kinds. This can be explained by the fact that public expenditure in Egypt does not influence the components which enhance genuine wealth while it

strongly impacts the components which reduce genuine wealth via the depletion of natural resources.

In order to corroborate these results, the impact of some subdivisions of total government expenditure on related components of genuine wealth has been measured. First the impact of expenditure on investments and of expenditure on subsidies on net savings has been investigated. The impact of expenditure on environmental protection was also studied in relation to the indexes measuring the damage resulting from carbon dioxide emissions and particle emissions, as shown in **Table (3)**.

The results of Table (3) backup the results of Table (2) for explaining the negative impact of total government expenditure and the majority of its subdivisions on total genuine wealth per capita in Egypt.

From the thirteenth model, it appears that investment expenditure (as a subdivision of total government expenditure) has a negative impact on net savings (as a component of genuine wealth). This result confirms that public investment in Egypt is mainly devoted to the replacement and renewal of old plants and is not channeled towards building new industries or an infrastructure that would incentivize new industrial activities. Besides, this result clarifies why government investment expenditure has a negative impact on total genuine wealth per capita in Egypt, as found in the third model, Table (1).

Table 3: Robustness check

<i>Dependent Variable</i>	<i>Reg (13)</i> <i>ln Net Saving</i>	<i>Reg (14)</i> <i>ln Net Saving</i>	<i>Reg (15)</i> <i>ln CO₂</i>	<i>Reg (16)</i> <i>ln Particles</i>
Long-run coefficients				
<i>ln Investment Gov. Exp.</i>	-0.1528 (-2.696)**			
<i>ln Subsidies Gov. Exp.</i>		-0.3442 (-2.984)**		
<i>ln Environment Gov. Exp.</i>			-0.1088 (-2.064)*	-0.9337 (-3.449)**
<i>ln Corruption</i>	-0.3325 (-7.445)***	-0.3536 (-4.199)***	0.0188 (0.194)	-0.0999 (0.236)
<i>ln Efficiency</i>	1.2506 (14.77)***	1.2909 (8.669)***	0.0898 (0.529)	-1.3549 (-2.622)*
<i>ln HDI</i>	4.3681 (9.269)***	5.7081 (6.599)***	6.0625 (10.26)***	13.148 (2.657)*
<i>ln Imports</i>	0.1542 (1.794)	-0.0473 (-0.358)	0.8389 (2.510)**	3.8126 (2.424)*
<i>Const</i>	3.2526 (6.003)***	5.3816 (5.625)***	2.8408 (7.467)***	2.8106 (0.834)

<i>Dependent Variable</i>	<i>Reg (13)</i> <i>ln Net Saving</i>	<i>Reg (14)</i> <i>ln Net Saving</i>	<i>Reg (15)</i> <i>ln CO₂</i>	<i>Reg (16)</i> <i>ln Particles</i>
Error correction coefficient				
Φ_i	-1.5939 (-16.29)***	-1.2155 (-10.61)***	-1.2103 (-4.339)***	-0.4144 (-2.276)*
Short-run coefficients:				
<i>ln GW per capita(-1)</i>	-1.5939 (-16.29)***	-1.2155 (-10.61)***	-1.2103 (-4.339)***	-0.4144 (-2.276)*
<i>ln Gov. Exp.</i>	-0.2435 (-2.819)**	-0.4184 (-3.132)**	-0.1316 (-2.048)*	-0.3869 (-4.989)***
Selected lag Model:	(3, 1, 2, 2, 2, 2)	(1, 2, 1, 1, 1, 2)	(3, 0, 2, 2, 1, 2)	(2, 2, 1, 2, 1, 2)
ARDL Bounds test:	10.107***	6.5549***	42.143***	92.891***
Adjusted R-squared	0.9937	0.9901	0.9888	0.9929
Fisher test (<i>F-stat.</i>)	(194.79)***	(162.28)***	(124.39)***	(198.84)***

Note: - ***, **, * indicate significance at 1%, 5% and 10% respectively.

On the other hand, government expenditure on environment protection has a negative impact on pollution as expressed by the indexes reflecting the damage resulting from carbon dioxide emissions and particle emissions, and evidenced by the fifteenth and the sixteenth models. In other words, when per capita government expenditure on environment protection increases, the per capita damage resulting from carbon dioxide emissions and particle emissions decreases. However, the impact of the total government expenditure on the depletion of natural resources is far greater than its impact on particle emissions, and this result confirms the absence of a relationship between government expenditure on environment protection and per capita genuine wealth, as apparent in the fifth model, in Table (1).

4.2. Strong sustainability and its econometric results using the ARDL model

Table (4) displays the effects of government expenditure per capita in Egypt and some of its subdivisions on the *per capita ecological footprint index* as a measure of strong environmental sustainability. Results reveal a negative impact of government expenditure and its subdivisions on strong environmental sustainability. Let us take a closer look to explain these results.

The seventeenth model underscores a positive relationship between total government expenditure per capita and the per capita ecological deficit in the long run. The estimator value is equal to 0.2542 and indicates that an increase of one unit in government expenditure per capita leads to an increase of 0.254 in the per capita ecological deficit.

Table (4): Government Expenditure and total ecological deficit in Egypt:

<i>Dependent Variable</i>	<i>Reg (17) ln EDC</i>	<i>Reg (18) ln EDC</i>	<i>Reg (19) ln EDC</i>	<i>Reg (20) ln EDC</i>	<i>Reg (21) ln EDC</i>
Long-run coefficients:					
<i>ln General Gov. Exp.</i>	0.2542 (7.456)***				
<i>ln Investment Gov. Exp.</i>		0.2738 (6.593)***			
<i>ln Subsidies Gov. Exp.</i>			0.5593 (3.234)**		
<i>ln Health Gov. Exp.</i>				0.6983 (3.594)***	
<i>ln Environment Gov. Exp.</i>					
<i>ln Corruption</i>	0.0309 (0.873)	0.0546 (2.053)*	0.4055 (1.965)*	0.5071 (2.326)**	
<i>ln Efficiency</i>	-0.2749 (-7.587)***	-0.0662 (-1.388)	-0.1874 (-3.118)**	-0.0445 (-0.235)	
<i>ln HDI</i>	0.1321 (0.435)	0.1062 (0.312)	1.4735 (1.460)	4.6285 (2.487)**	
<i>ln Imports</i>	0.1855 (3.489)**	-0.0125 (-0.239)	-0.3875 (-1.506)	-0.0707 (-0.288)	
<i>Const</i>	2.7407 (6.878)***	2.6244 (5.673)***	6.3121 (2.893)**	5.8186 (3.643)***	
Error correction coefficient					

	<i>Reg (17)</i>	<i>Reg (18)</i>	<i>Reg (19)</i>	<i>Reg (20)</i>	<i>Reg (21)</i>
<i>Dependent Variable</i>	<i>ln EDC</i>	<i>ln EDC</i>	<i>ln EDC</i>	<i>ln EDC</i>	<i>ln EDC</i>
Φ_i	-2.6808 (-11.09)***	-1.6725 (-9.721)***	-0.9165 (-12.13)***	-0.9734 (-7.088)***	
Short-run coefficients:					
<i>ln GW per capita(-1)</i>	-2.6808 (-5.622)***	-1.6725 (-4.942)***	-0.9165 (-2.456)**	-0.9734 (-4.162)***	
<i>ln Gov. Exp.</i>	-0.6814 (-5.410)***	-0.4579 (-3.643)***	-0.5126 (-4.339)***	-0.6797 (-3.553)***	
Selected lag	(3, 1, 2, 2, 2, 1)	(3, 2, 0, 0, 1, 0)	(3, 2, 1, 2, 2, 0)	(1, 1, 2, 2, 2, 2)	(1, 0, 0, 0, 0, 0)
Model:					
ARDL	8.7884***	8.7359***	11.319***	4.1017**	1.5481
Bounds test:					
Adjusted R-squared	0.9605	0.9703	0.9725	0.9313	0.8802
Fisher test (<i>F-stat.</i>)	(34.46)***	(66.42)***	(52.94)***	(21.79)***	(30.38)***

Note: - ***, **, * indicate significance at 1%, 5% and 10% respectively.

This finding was expected from our earlier analysis since government expenditure in Egypt was unable to support weak environmental sustainability. The studied subdivisions of government expenditure per capita had also the same effect on the ecological deficit per capita. Thus government expenditure on investment, environmental protection, and health care had a negative impact on strong environmental sustainability in Egypt. Moreover, there was no co-integration relationship between government expenditure on environment protection and strong environmental sustainability in Egypt during the study period.

This result is compatible with the findings of other studies, the most recent one being that of **Moshiri, S. and Daneshmand, A., 2019.**

5. Findings and Deductions

This study aimed at exploring recent trends of the government expenditure role in the field of environmental quality improvement. Using the descriptive approach, the study presented the most important concepts related to environment protection, such as: Sustainable development, the green growth or the green economy, relevant concepts advanced by the Organization for Economic Cooperation and Development (OECD). It tackled the difference between PACE, EPE,

Environmental Management Expenditure, as well as biological diversity and environmental sustainability and its objectives. An overview of the most important previous studies in this context was then displayed.

In addition, an empirical study was carried out to explore long-run and short-run effects of government expenditure on environmental performance in Egypt during the period (1990 – 2017). The cointegration method was applied via using the autoregressive distributed lag (ARDL) model. Results revealed a negative impact of per capita total government expenditure – and of its subdivisions - on genuine wealth per capita (as a measure of weak environmental sustainability) in the long run. This is due to the fact that the structure of public expenditure in Egypt does not support the realization of a positive change in genuine wealth per capita. Hence approximately one-third of public expenditure goes to debt repayment and debt service, thus representing what the current generations have to bear for what previous generations have consumed. Moreover, about two-thirds of public expenditure in Egypt is devoted to paying the salaries of the expanded public sector and settling the bill of subsidies. The outstanding balance - or approximately 10% - is used to cover all the other requirements including health care, education, scientific research, investments, and others.

Moreover, the study found a positive relationship between per capita government expenditure and per capita ecological deficit (as a measure of strong environmental sustainability) in the long run.

Therefore, the Egyptian government is called to redress the structure of public expenditure towards boosting the fields liable to increase the country's genuine wealth, such as education and scientific research, investing in new production structures and building an infrastructure capable of incentivizing the industrial sectors.

Furthermore, the Egyptian government should curtail its spending on the activities that cause the depletion of all sorts of natural resources (fossil energy, minerals, and forests) and thus reduce per capita genuine wealth. The State should also reduce its consumption of natural resources (pastures and agricultural lands, forests and fisheries), known as the ecological footprint, to the level of the country's biocapacity in order to realize an environmental equilibrium.

It is noteworthy that Egypt is currently exerting great efforts towards realizing the green growth economy. The issuance of green

bonds has already started as above-mentioned. Besides, the Public Authority for New and Renewable Energy is encouraging the establishment of solar energy projects and solar sheets complexes. The State has also launched a number of environment friendly- projects such as the electric train and electric drive vehicles. El Nasr for Cars Co., a public sector company, has already signed a contract with Chinese companies for producing electric drive cars to be launched on the market in 2022. Moreover, the Egyptian government is currently implementing a large number of infrastructure projects such as new roads and bridges, and new cities, that are expected to promote new production activities and incentivize the private sector to expand production. In this way, the realized value added of products is expected to increase, followed by savings which represent one of the components of genuine wealth. All these efforts are steps on the way of realizing the green growth economy and environmental sustainability in Egypt.

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