Chapter 13
The Link Between E-Waste and Linear Economy Through a Bootstrap Rolling Window Analysis

Mikail Pehlivan
https://orcid.org/0000-0002-7273-333X
Trakya University, Turkey

Şahin Akkaya
https://orcid.org/0000-0003-2394-7232
Istanbul University, Turkey

ABSTRACT

It is known that the dominant economic doctrine in the current economic system is neoclassical economics. The fact that waste electrical and electronic equipment (e-waste) is the fastest growing solid waste in the world may be an important indicator of this linear production and consumption economy model. Therefore, this study empirically tests the relationship between e-waste and (linear) economic growth. According to this analysis, the relationship between total e-waste and economic growth in the countries included in the study (USA, Germany, Australia, Brazil, China, Ghana, South Korea, India, Switzerland, Japan, Türkiye) was tested with panel bootstrap causality analysis using annual data for the period 1960-2020. According to the findings of the analysis, a bidirectional causality is found between e-waste and economic growth in all sub-samples for all countries. In this respect, it can be stated that within the framework of the sustainable production and consumption

DOI: 10.4018/979-8-3693-7383-5.ch013

paradigm, a transition from a linear economy to a circular economy seems essential.

INTRODUCTION

Technological development is an important factor in increasing economic welfare for all countries (Romer 1990). Today, electrical and electronic equipments (e-products) have become indispensable in all aspects of modern life. E-products, including information and communication technology* (ICT), represent an important factor that will shape further development. Similar to capital, new technology plays a key role in economic growth in all countries, and this is particularly evident in the last few decades (Erumban and Das 2016; Jorgenson et al. 2016).

In 2010, internet use contributed 1.9% to Gross Domestic Product (GDP) in a group of 30 developing/emerging countries (EC) and 3.4% in developed countries (DC) (Nottebohm et al. 2012). However, this technological progress not only improves the living standards of the society, but also brings along the problem of waste generation (Panambunan-Ferse and Breiter 2013; Umair et al. 2015; Chatterjee and Abraham 2017). Waste electrical and electronic equipments (e-waste) from technological development represents the fastest growing waste group with an annual increase of 4.5% (Yang et al. 2017; Qu et al. 2019). However, while e-product use is increasing, its impact on countries' economic growth varies (Prasad 2012; Hofman et al. 2016; Donou-Adonsou 2019). Similarly, the increase in e-waste also differs across countries, such that the rate of increase in EC is faster than that of the DC (Sthiannopkao and Wong 2013).

Recycling, a central concept in the circular economy, aims to minimize environmental impact. The recycling rate often indicates the percentage of waste directed toward material recovery (Oughton et al. 2022), reflecting progress in environmental conservation and efficient resource management. Countries with higher recycling rates generally produce less waste (Islam et al. 2019), emit fewer greenhouse gases (Magazzino et al. 2020), and experience increased economic growth and job opportunities (Liu et al. 2020).

Recycling provides three key advantages: i) economic, ii) environmental, and iii) public health and safety. To begin with, e-waste holds substantial economic value due to the precious metals it contains. However, fewer than 22% of global e-waste is processed for recycling, and only 1% of the demand for rare earth elements is fulfilled through e-waste recycling (Baldé et al. 2024). Furthermore, inadequate e-waste management results in the loss of valuable materials and leads to an increased need for mining to obtain primary resources. The concentration of metals in e-waste far exceeds that found in traditional mining operations. Research indicates that the quality of global ore is declining, forcing mining operations to

Applications of Advanced Oxidation Processes in Palm Oil Mill Effluent Treatment

Azmi Aris, Muhammad Noor Hazwan Jusohand Nurul Shakila Ahmad Abdul Wahab (2019). *Advanced Oxidation Processes (AOPs) in Water and Wastewater Treatment (pp. 123-149).*

www.irma-international.org/chapter/applications-of-advanced-oxidation-processes-in-palm-oil-mill-effluent-treatment/209303