# Chapter 40
# Economic Growth and Climate Change:
## An Exploratory Country-Level Analytics Study

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## ABSTRACT

*In this article, the authors use analytics to explore the association between economic growth and climate change at a country-level. They examine different indicators to better understand the macro issues and guide policy decision-making. The authors analyze global economic growth and climate change using the World Bank data of 131 countries and 16 indicators for the period 2005 to 2010. The analysis shows overall economic growth is positively associated with climate change. This implies country leaders should design and implement structured development plans if they are to promote economic growth to alleviate poverty while simultaneously mitigating climate change.*

## INTRODUCTION

According to scientists and policymakers, the earth's climate is changing. Temperatures are rising, snow and rainfall patterns are shifting, and extreme weather events—intense rainstorms, record-high temperatures, alternating cyclone/hurricane occurrences and long dry spells—are wreaking havoc in different parts of the world (International Monetary Fund, 2008; U.S. Environmental Protection Agency, 2016). Researchers are generally confident that many of these changes and trends are associated with increased levels of carbon dioxide and other greenhouse gases (GHG) in the earth's atmosphere, and that these increases have been brought about by human activities (International Monetary Fund, 2008; U.S. Environmental Protection Agency, 2016)). Climate change refers to "any substantial change in

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measures of climate (such as temperature or precipitation), lasting for an extended period (decades or longer). Natural factors have caused the climate to change during previous periods of the Earth's history, but human activities are the primary cause of the changes that are being observed now (International Monetary Fund, 2008; Stern, 2006; The National Academies Press, 2010a, 2010b; U.S. Environmental Protection Agency, 2016)." Human activities are generally understood to include economic development and growth activities (The National Academies Press, 2010a, 2010b; Ward and Shively, 2012).

The primary sources of greenhouse gases, in order of importance, are: electricity generation, land-use changes (e.g., deforestation), agriculture, and transportation (International Monetary Fund, 2008; Stern, 2006; The National Academy of Sciences, 2014). While the literature strongly suggests rich (developed) countries have historically dominated emissions, and poor (developing) countries will contribute to the rise in emissions rapidly, the current debate and global talks on climate change center around how to mitigate climate change while keeping equity and poverty reduction (Soubbotina, 2004; Tol, 2009) in mind (International Monetary Fund, 2008; Markandya, 2011). For example, increases in energy-related emissions of carbon dioxide, the largest and fastest growing source of GHG emissions, are primarily driven by growth in GDP capita and population increases, and these increases are only partially offset by more efficient use of energy (Markandya, 2011; Ward and Shively, 2012). While China, India, and other developing countries contribute to most of the growth in emissions, developed countries account for most energy-related emissions in the past and, thus, for most of the current stock of these emissions (Markandya, 2011). When changes in land-use and deforestation are considered, however, advanced countries are responsible for less than half of the current stock of total emissions (Markandya, 2011). In other words, the amount of carbon dioxide a country emits into the atmosphere depends mainly on the size of that country's economy, the level of its industrialization, and the efficiency of its energy use (Mattoo and Subramanian, 2012; Raghupathi and Raghupathi, 2016; The National Academies Press, 2010b). Until now, though developing countries contain most of the world's population, their industrial production and energy consumption per capita have been relatively low. There can be little doubt that the primary responsibility for global warming lies with developed countries. But the link between economic growth and increased energy consumption, in conjunction with increased carbon dioxide emission, is direct and positive for all countries (Mattoo and Subramanian, 2012). That said, at high-income levels, there are indications of lower per capita energy consumption and pollution despite economic growth (Raghupathi and Raghupathi, 2016; The National Academies Press, 2010b) explained by increased efficiency in energy use thanks to environmentally cleaner technologies. Also, a higher-income country will typically demand a proportionally larger service sector, and service is a far less energy intensive sector compared to, say, manufacturing (Mattoo and Subramanian, 2012).

In summary, we know that developed countries have to reduce emissions, and they need to identify innovative strategies and technologies to develop and use. Furthermore, developed countries need to transfer and make these technologies available to developing countries. Progressive development assistance and aid have to be provided to developing countries, engaging them in rapid economic development and poverty reduction, and at the same time, keeping greenhouse gas emissions in check (The National Academies Press, 2010a). However, considering most developing countries do not commit to reduce greenhouse gas emissions, arguing that these commitments would undermine their economic development and impede poverty alleviation, finding the right balance between economic growth and climate change is a key challenge (Mattoo and Subramanian, 2012; The National Academies Press,2010a; United Nations Development Program, 2013). Naturally, all countries contemplating mitigation will want to