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## Energy Consumption, Economic Growth and CO2 Emissions in Middle East and North African Countries

This article extends the recent findings of Liu (2005), Ang (2007), Apergis et al. (2009) and Payne (2010) by implementing recent bootstrap panel unit root tests and cointegration techniques to investigate the relationship between carbon dioxide emissions, energy consumption, and real GDP for 12 Middle East and North African Countries (MENA) over the period 1981-2005. Our results show that in the long-run energy consumption has a positive significant impact on CO2 emissions. More interestingly, we show that real GDP exhibits a quadratic relationship with CO2 emissions for the region as a whole. However, although the estimated long-run coefficients of income and its square satisfy the EKC hypothesis in most studied countries, the turning points are very low in some cases and very high in other cases, hence providing poor evidence in support of the EKC hypothesis. Thus, our findings suggest that not all MENA countries need to sacrifice economic growth to decrease their emission levels as they may achieve CO2 emissions reduction via energy conservation without negative long-run effects on economic growth.

# Advances in Longitudinal Data Methods in Applied Economic Research

## 2020 International Conference on Applied Economics (ICOAE)

Springer Nature This volume presents new methods and applications in longitudinal data estimation methodology in applied economic. Featuring selected papers from the 2020 the International Conference on Applied Economics (ICOAE 2020) held virtually due to the corona virus pandemic, this book examines interdisciplinary topics such as financial economics, international economics, agricultural economics, marketing and management. Country specific case studies are also featured.

## Energy consumption, environmental contaminants, and economic growth: The G8 experience

Litres Environmental pollution has increasingly become an issue of global concern because of climate change and consciousness for environmental sustainability. To this end, this paper investigates the relationship between energy consumption, carbon dioxide (CO<sub>2</sub>) emissions and economic growth of the G8 countries over the period of 56 years spanning 1960 through 2015 using both the Fully Modified and Dynamic OLS estimation techniques. The empirical investigation establishes the critical roles played by energy consumption and CO<sub>2</sub> emissions on economic growth but in substantially opposite directions. While that of the former positively enhances economic growth, on the one hand, the latter negatively deters it. In addition, a long-run relationship is equally established but with the varied direction of causality. Finally, the study offers significant policy implications directed at using energy resource efficiently as well as curtailing environmental contaminants.

## Energy Consumption, Economic

# Growth and CO2 Emissions in Middle East and North African Countries

## Energy and Environmental Strategies in the Era of Globalization

Springer This book provides readers with cutting-edge techniques that can be applied to energy and environmental economics. Further, it highlights the effects that both globalization and economic growth have on the environment. In addition to offering a broader perspective on the relationship between environmental pollution, energy consumption and economic growth, the book studies the relationship between economic growth and environmental damage by drawing on the theoretical hypothesis of the Environmental Kuznets Curve. The book presents new econometric techniques and innovative approaches to the study of the energy economy. Accordingly, it can be used to help analyse the current state of the energy economy, the environment and globalization, and can serve as a theoretical reference manual for doctoral students and academics seeking new analytical techniques.

## Energy Use and Carbon Emissions

### Some International Comparisons

### Low Carbon Policy and Development in Taiwan

BoD - Books on Demand Taiwan a typical small Asian country with few energy resources is well known for its high-tech industry in the last 20 years. However as a member of the global village Taiwan feels the responsibility to reduce carbon emissions. The book tells you how Taiwan transforms itself from a high-tech island to become a low carbon island. The book address Taiwan's low-carbon developmental policies of the past 10 years, applies an econometric approach to estimate Taiwan's sector department CO2 emissions, shows how environmental change affects the economic growth of Taiwan, and provides two successful examples of low-carbon pilot regions in Taiwan. Stephen Shen, the Minister of the Environment Protection

Agency of Taiwan, believes that the book arrives at the right time, because this is the time to educate the people of Taiwan, about the necessary action for achieving a low carbon society.

# Energy Consumption, Carbon Dioxide Emissions and Economic Growth: The Case of Saudi Arabia

## Environmental Kuznets Curve (EKC)

### A Manual

Academic Press Environmental Kuznets Curve (EKC): A Manual provides a comprehensive summary of the EKC, summarizing work on this economic tool that can analyze environmental pollution problems. By enabling users to reconcile environmental and economic development policies, Environmental Kuznets Curve studies lend themselves to the investigation of the energy-growth and finance-energy nexus. The book obviates a dependence on outmoded tools, such as carrying capacity, externalities, ecosystem valuation and cost benefit analysis, while also encouraging flexible approaches to a variety of challenges. Provides a comprehensive summary of EKC studies, including advances in econometrics, literature reviews and historical perspectives Outlines solutions to common problems in applying EKC techniques by reviewing major case studies Explores frequently-utilized proxies for environmental quality

## Investing in Low-Carbon Energy Systems

## Implications for Regional Economic Cooperation

Springer This book focuses on multi-level actions that have attracted considerable interest and discussion within academia, decision makers and the public as a tool to assess anthropogenic effects of low-carbon energy development. The book begins with an overview of the state of the art policies in emerging economies, which provides a starting point for understanding the concept of low-carbon green growth. A unified framework for structuring, categorizing, and integrating various regional-level actions is established on the basis of a thorough investigation into the

theoretical and methodological aspects of non-conventional energy policies that have been widely adopted. Furthermore, the book brings clarity to the relationship between clean energy policies and stakeholder participation, and the significance of coordinated actions at the regional level. The findings provide novel insights and policy tools to help decision-makers in identifying ways to mobilize private investment in low-carbon energy systems.

## Assessment of Energy–Environment–Economy Interrelations

MDPI Energy consumption and economic growth have been of great interest to researchers and policy-makers. Knowing the actual causal relationship between energy and the economy with respect to environmental degradation has important implications for modeling environmental and growth policies. The eleven chapters included herein aim to help researchers, academicians, and especially decision-makers to understand relevant issues and adopt appropriate methods to tackle and solve relevant environmental problems. Various methods from different disciplines are proposed and applied to various environmental and energy issues.

## Energy Security and Sustainable Economic Growth in China

Springer This book focuses on various issues of energy, energy efficiency and environmental policy in China. It discusses different aspects on how China may maintain its fast economic growth through good management of energy consumption and development of various energy sources.

## Carbon Dioxide Emissions, Gross Domestic Product And Energy Consumption: Effect Of The Kyoto Protocol

Akademisyen Kitabevi

# Revisiting the Relationships Between Non-Renewable Energy Consumption, CO2 Emissions and Economic Growth in Iran

Exploring the short-run and long-run relationships between consumption of various sources of non-renewable energy, economic growth and carbon dioxide (CO2) emissions would be considered as a golden key to provide rational energy policies of Iran in the post sanctions era. The aim of this paper is to find these mentioned relationships by using the Johanesen cointegration approach, the VECM Granger causality test, Generalized impulse responses functions and variance decomposition in Iran for the period 1966-2013. The findings support evidence for the existence of long-run linkage between non-renewable energy consumption, economic growth and CO2 emissions. The short-run relationship examination proves the causality running from non-renewable energy consumption to economic growth in Iran. The variance decomposition highlights that economic growth changes are explained more by gas consumption than by consumption of other non-renewable energy resources. Furthermore the contribution to CO2 emissions is mainly from oil consumption. The study recommends some new policy insights for Iran in order to reach a higher economic growth by non-renewable energy resources, while lower carbon dioxide emissions.

## Relationships Among Carbon Emissions, Economic Growth, Energy Consumption and Population Growth

## Testing Environmental Kuznets Curve Hypothesis for Brazil, China, India and Indonesia

This study examines the impacts of income, energy consumption and population growth on CO2 emissions by employing an annual time series data for the period

1970-2012 for India, Indonesia, China, and Brazil. The study used the Autoregressive Distributed Lag (ARDL) bounds test approach considering both the linear and non-linear assumptions for related time series data for the top CO2 emitter emerging countries in both the short run and long run. The results show that CO2 emissions have increased statistically significantly with increases in income and energy consumption in all four countries. While the relationship between CO2 emissions and population growth was found to be statistically significant for India and Brazil, it has been statistically insignificant for China and Indonesia in both the short run and long run. Also, empirical observations from the testing of environmental Kuznets curve (EKC) hypothesis imply that in the cases of Brazil, China and Indonesia, CO2 emissions will decrease over the time when income increases. So based on the EKC findings, it can be argued that these three countries should not take any actions or policies, which might have conservative impacts on income, in order to reduce their CO2 emissions. But in the case of India, where CO2 emissions and income were found to have a positive relationship, an increase in income over the time will not reduce CO2 emissions in the country.

## Energy Consumption, Economic Growth, Carbon Dioxide Emissions and Population: Causality Relationship in Latin American and The Caribbean Countries

### Essays on China's Energy Consumption, Carbon Emissions and Economic Growth

ProQuest The three articles are interconnected and meanwhile they are also independent studies viewed separately.

## On the Relationship Among Energy Consumption, Carbon Dioxide

# Emissions, and Economic Growth

## The Case of Korea

## Economic Growth, Energy

## Consumption and CO2 Emissions in Sweden, 1800-2000

The PhD dissertation discusses large transformations of technologies have occurred in the Swedish economy during the last two centuries, resulting in higher income, better quality of products and changing composition of GDP. An agrarian society has given way to an industrial society and lately to a post-industrial phase. The energy supply systems have changed, from traditional energy carriers, such as firewood and muscle energy to modern carriers like coal, oil and electricity, with effects on CO2 emissions. Not only has the energy supply gone through fundamental changes, but also forest management, which affects the net emissions of CO2. The interrelations of growth, energy and CO2 are analyzed in this thesis, which uses standard calculations

## Econometrics of Green Energy

## Handbook

## Economic and Technological

## Development

Springer Nature This book gathers cutting-edge studies on the relationship between energy innovations, economic growth, environmental regulation, promotion of renewable energy use, and climate change. Building on the research discussed in the editor's previous book Decarbonization and Energy Technology in the Era of Globalization, it discusses recent developments such as the impacts of globalization and energy efficiency on economic growth and environmental quality. It also explores the ways in which globalization has benefited green energy development, e.g. the expansion of new technologies and cleaner machinery, as well as the problems it has caused. Written by respected experts, the respective contributions address topics including econometric modelling of the behaviour of and dynamics between economic growth and environmental quality, aspects of energy production and consumption, oil prices, economic growth, trade openness, environmental

quality, regulatory measures, and innovations in the energy sector. Providing a comprehensive overview of the latest research, the book offers a valuable reference guide for researchers, policymakers, practitioners and students in the fields of renewable energy development and economics.

## Long and Short-Run Linkages Between Economic Growth, Energy Consumption and CO2 Emissions in Tunisia

This paper provides some insights into the linkages between energy consumption, carbon emissions and the sectoral components of output growth using Tunisian data over the period 1971 to 2005. Results of the long-run analysis do not support the neutrality hypothesis between energy consumption and sectoral output growth in Tunisia. Results from short-run dynamics indicate that linkages between energy consumption and economic growth, as well as economic growth and environmental pollution are not uniform across sectors (agriculture, industry and services). These outcomes suggest that prudent energy and environmental policies should distinguish the differences in the relationship between energy consumption and output growth by sector.

## China's Dilemma

## Economic Growth, the Environment, and Climate Change

Brookings Institution Press The economic growth of China is clearly one of the defining trends of our time. The world's most populous nation is undergoing a vast transformation that will redefine the global economy. Chinese industrial production has increased tremendously in recent years, and its consumption of resources has necessarily gone way up as well. These developments will have important impacts on economics, business, politics, and environmental conditions throughout the world. In *China's Dilemma: Economic Growth, the Environment, and Climate Change*, an international group of authorities examines the present status and likely future of China's economic rise and its impact on the environment, with particular focus on the all-important topic of global climate change. The first section addresses directly China's recent growth. Specific topics addressed here include the effects on China of the global credit crunch, determinants of growth, and their prospects for the future. Part II addresses China's environmental and climate concerns, including the impact on human health, their role in domestic politics, the health effects of environmental

damage, and China's post- Kyoto climate strategy. Part III looks at the impact, and likely trajectory, of energy consumption in China. Contents Part I. Economic Growth: Determinants and Prospects Includes introduction Part II. Impact of Environment Degradation and Climate Change Part III. Energy Use, the Environment, and Future Trends

## Strategies in Sustainable Tourism, Economic Growth and Clean Energy

Springer Nature This book provides an in-depth analysis of and discussion about the relationship between green tourism, economic growth and globalization. It explores numerous topics relating to tourism including transport efficiency, foreign direct investment, clean energy, climate change dynamics and advances in sustainable tourism management. The book begins with discussion of sustainable tourism and economic growth, particularly focusing on management strategies. It then presents the relationship between energy use and tourism, looking at green energy and energy shock. It then discusses transport efficiency, tourism efficiency and financial growth in both developed and developing countries. This book is of interest to researchers, policymakers, and postgraduate students in the areas of energy, environmental and tourism economics.

## Hacia el Futuro

## Energy, Economics and the Environment in 21st Century Mexico

Springer Science & Business Media The book focuses on the impact of energy policies on fossil fuel use, environmental quality, and economic growth in Mexico for the next 20 years. It examines the Mexican energy sector and its link to international trade, government revenues, economic welfare and environmental pollution. It also develops a Computable General Equilibrium model of the Mexican economy, paying attention to the energy sector and its links with other aspects of the aggregate economy.

## The Economics of Climate Change in China

# Towards a Low-Carbon Economy

Routledge China faces many modernization challenges, but perhaps none is more pressing than that posed by climate change. China must find a new economic growth model that is simultaneously environmentally sustainable, can free it from its dependency on fossil fuels, and lift living standards for the majority of its population. But what does such a model look like? And how can China best make the transition from its present macro-economic structure to a low-carbon future? This groundbreaking economic study, led by the Stockholm Environment Institute and the Chinese Economists 50 Forum, brings together leading international thinkers in economics, climate change, and development, to tackle some of the most challenging issues relating to China's low-carbon development. This study maps out a deep carbon reduction scenario and analyzes economic policies that shift carbon use, and shows how China can take strong and decisive action to make deep reductions in carbon emission over the next forty years while maintaining high economic growth and minimizing adverse effects of a low-carbon transition. Moreover, these reductions can be achieved within the finite global carbon budget for greenhouse gas emissions, as determined by the hard constraints of climate science. The authors make the compelling case that a transition to a low-carbon economy is an essential part of China's development and modernization. Such a transformation would also present opportunities for China to improve its energy security and move its economy higher up the international value chain. They argue that even in these difficult economic times, climate change action may present more opportunities than costs. Such a transformation, for China and the rest of the world, will not be easy. But it is possible, necessary and worthwhile to pursue.

## Global Energy Dilemmas

John Wiley & Sons Today's global energy system faces two major challenges: how to secure the supply of reliable and affordable energy; and how to rapidly transform to a low-carbon, efficient and environmentally harmless energy supply. In this rigorous and illuminating book, Michael Bradshaw explores the key aspects of the current global energy dilemma and examines how it is playing out across the major regions and countries of the world. The book begins by charting the development of the current global energy system - exploring its key characteristics with a focus upon energy security and the relationship between energy, economic development and climate change. The next four chapters offer in-depth analyses of four distinct global energy dilemmas in different parts of the world: the challenge of sustaining affluence and decarbonising energy services in the high-energy economies of the developed world; the legacies of the centrally planned economy and the consequences of liberalisation in the post-socialist world; growing energy demand and emissions growth associated with the emerging regions; and finally, the quest to provide universal access to modern energy services in the developing world in a manner that is both economically and environmentally sustainable. Identifying the governance structures and policy options available to tackle the global energy dilemma, the book

concludes that only an integrated approach - sensitive to regional issues - can reconcile the interests and needs of those facing differing energy challenges across the world today.

## Energy-Emissions Trends and Policy Landscape for India

Allied Publishers India's energy system has evolved around domestic coal, sizable imports of oil and LNG, moderate contribution of hydro power, declining and yet sizable use of traditional biomass as cooking fuel by rural households and growing attention to modern renewable, nuclear and energy efficient technologies. India's per-capita GHG emissions are below the global average and far below those in the developed countries. Notwithstanding the inherited fossil based energy system and high economic growth expectations, India voluntarily committed to reduce GHG emissions intensity of the economy by 20-25 per cent from 2005 to 2020. This book details inventory of energy and emissions at national and sector levels. It maps firm and locale level energy use and emissions and their impacts such as on the urban air pollution. The future energy and emissions trends are analyzed following scenarios analysis using integrated assessment modelling framework that aligns India's national development goals with global climate change actions. The analysis shows that the global 2°C temperature stabilization target shall require fundamental transformation of India's energy system, both on demand and supply sides. The book demonstrates the necessity and validity of following a long-term development-centric perspective; even while delineating near-term energy and emissions policies, programs and targets such as those needed to delineate the Intended Nationally Determined Contributions (INDCs). The book, while illustrating the best practice modeling, scenarios development and policy assessment for India, provides insights into the mode and means of navigating the energy and emissions policy landscape for India. The complexity of the policymaking notwithstanding, the book is intended to demystify the methods and means for delineating the policies. The book, we hope demonstrates the need to use best practice methodologies for national assessments and also the existence of the scientific capacity in the country to carry out such assessments.

## Carbon Footprint and the Industrial Life Cycle

### From Urban Planning to Recycling

Springer This book analyzes the relationship between large-scale industrial activity and the carbon footprint, and provides a theoretical framework and tools to calculate the carbon footprint of industrial activities at every stage of their life cycles.

including urban-planning master plans, recycling activities, project and building stages as well as managing and manufacturing. Discussing the main preventative and corrective measures that can be utilized, it includes case studies, reports on technological developments and examples of successful policies to provide inspiration to readers. This book collects the contributions of authors from four continents, in order to analyze from as many as possible points of view and using many different approaches, the problem of sustainability in today's globalized world.

## Crossing the Energy Divide

### Moving from Fossil Fuel Dependence to a Clean-Energy Future

Pearson Prentice Hall If we continue our highly inefficient, dangerous energy usage, we're headed for both economic and environmental catastrophe. However, the hard truth is that alternative fuels can't fully replace fossil fuels for decades. What's more, new research indicates that energy inefficiencies are retarding economic growth even more than most experts ever realized. Crossing the Energy Divide is about solving all these problems at once. The authors, two leading experts in energy and environmental economics, show how massive improvements in energy efficiency can bridge the global economy until clean renewables can fully replace fossil fuels. Robert and Edward Ayres demonstrate how we can radically reform the way we manage our existing energy systems to double the amount of "energy service" we get from every drop of fossil fuel we use. These techniques require no scientific breakthroughs: Many companies and institutions are applying them right now, but tens of thousands more could. This book offers a strategic guide for using them to solve the energy crisis once and for all—reducing carbon emissions, achieving true energy security, and reigniting economic growth for decades to come. More energy, without more emissions Recapturing lost energy from today's fossil fuels There is such a thing as a free lunch Mitigating climate disaster and improving prosperity at the same time The future of electricity Reforming tomorrow's electrical system: smarter, more productive, and more reliable The implications for cities, transportation, business, and government Making the decisions that prepare you for a high-cost energy future

## Renewable Energy Consumption, Economic Growth and CO2

# Emissions

## Evidence from Selected MENA Countries

This paper uses panel cointegration techniques to examine the causal relationship between renewable energy consumption, economic growth and CO2 emissions for a group of 12 MENA countries covering the annual period 1975-2008. The Granger-causality results indicate that there is no causal relationship between these variables in short run except a unidirectional causality running from renewable energy consumption to CO2 emissions. However, we find unidirectional causality running from economic growth and CO2 emissions to renewable energy consumption in long run. With panel FMOLS and DOLS estimates, we find that only CO2 emissions have an impact on renewable energy consumption. These results indicate that MENA countries don't find the best policy which can control the regulation of the renewable energy prices, which can help to take into account the stability in the economic growth structure, and which can also mitigate pollutant emissions.

## The Development of Renewable Energy Sources and its Significance for the Environment

Springer This book analyzes the effects of power generated by renewable energy sources, renewable energy production technologies, energy efficiency, and market regulation of carbon emissions. It elaborates on how these parameters have direct and indirect effects on carbon emission reduction, such as the results of an environmental tax that could directly reduce carbon emissions by decreasing fossil fuel consumption or by stimulating energy savings through technological innovation, as well as how renewable energy sources can affect both economic growth and the environment. In addition to a detailed analysis of the interrelationships between renewable energy consumption, production technology, and market regulation, The Development of Renewable Energy Sources and its Significance for the Environment proposes a model for measuring the effectiveness and results of the interaction between these links. Furthermore, a structure for a marketplace of renewable energy sources is put forward, as well as an outline of the requirements that must be met in order for this market to function. Suitable policy recommendations to enhance the market for renewable energies are also provided.

# Financial Development and Dynamic Investment Behavior Evidence from Panel Vector Autoregression

World Bank Publications Love and Zicchino apply vector autoregression to firm-level panel data from 36 countries to study the dynamic relationship between firms' financial conditions and investment. They argue that by using orthogonalized impulse-response functions they are able to separate the "fundamental factors" (such as marginal profitability of investment) from the "financial factors" (such as availability of internal finance) that influence the level of investment. The authors find that the impact of the financial factors on investment, which they interpret as evidence of financing constraints, is significantly larger in countries with less developed financial systems. The finding emphasizes the role of financial development in improving capital allocation and growth. This paper--a product of Finance, Development Research Group--is part of a larger effort in the group to study access to finance.

# CO2 Emissions, Energy Consumption and Economic Growth Evidence from the Trans-Pacific Partnership Modeling and Simulation of Carbon Emission Related Issues

MDPI Carbon emissions reached an all-time high in 2018, when global carbon dioxide emissions from burning fossil fuels increased by about 2.7%, after a 1.6% increase in 2017. Thus, we need to pay special attention to carbon emissions and work out possible solutions if we still want to meet the targets of the Paris climate agreement. This Special Issue collects 16 carbon emissions-related papers (including 5 that are carbon tax-related) and 4 energy-related papers using various methods or models, such as the input-output model, decoupling analysis, life cycle impact analysis (LCIA), relational analysis model, generalized Divisia index model (GDIM), forecasting

model, three-indicator allocation model, mathematical programming, real options model, multiple linear regression, etc. The research studies come from China, Taiwan, Brazil, Thailand, and United States. These researches involved various industries such as agricultural industry, transportation industry, power industry, tire industry, textile industry, wave energy industry, natural gas industry, and petroleum industry. Although this Special Issue does not fully solve our concerns, it still provides abundant material for implementing energy conservation and carbon emissions reduction. However, there are still many issues regarding the problems caused by global warming that require research.

## The Nexus of CO2 Emissions, Energy Consumption, Economic Growth, and Trade-openness in WTO Countries

### Co2 Emissions, Energy Consumption and Economic Growth Nexus in MENA Countries Evidence from Simultaneous Equations Models

This paper examines the nexus between CO2 emissions, energy consumption and economic growth using simultaneous-equations models with panel data of 14 MENA countries over the period 1990-2011. Our empirical results show that there exists bidirectional causal relationship between energy consumption and economic growth. However, the results support the occurrence of unidirectional causality from energy consumption to CO2 emissions without any feedback effects, and there exists bidirectional causal relationship between economic growth and CO2 emissions for the region as a whole. The study suggests that environmental and energy policies should recognize the differences in the nexus between energy consumption and economic growth in order to maintain sustainable economic growth in MENA region.

# Carbon Charges as a Response to Global Warming

## The Effects of Taxing Fossil Fuels

## Green Growth, Smart Growth

## A New Approach to Economics, Innovation and the Environment

Anthem Press We find ourselves at a crossroads between environmental disaster and a new industrial revolution: a shift from the ruthless exploitation of nature toward cooperation with it. Decoupling economic growth from environmental consumption is an ambitious goal, but also an achievable one. 'Green Growth, Smart Growth' outlines a way forward in this great transformation, and does so in the conviction that the dangers posed by climate change can be overcome through a new approach to economics, innovation and proactive policymaking.

## Environment, Energy, and Economy Strategies for Sustainability

United Nations Univ This book deals with short-term and long-term issues associated with directions of economic development in developing as well as industrialized countries. It examines various aspects of the interrelationships among the environment, energy requirements, and economic development-- a topic much discussed since the Rio Earth Summit. It emphasizes the increasing environmental stress arising from such human activities as growing energy consumption associated with economic development; the risk of further environmental degradation due to economic development in developing countries; the importance of global environmental problems such as climate change resulting from greenhouse gas emissions; the significance of impacts of deforestation and desertification on rural societies in the developing world; the role of new technologies in addressing the trilemma of energy demand, economic development, and the environment; the opportunity for the developing economies through implementing technological leapfrogging and phased approaches; and the need for removing technological, economic, and social barriers to achieving sustainable development. It underscores the need for further scientific information and analytical studies, such as improved climate and econometric modelling. The book will be of tremendous value to experts

and policy makers dealing with energy and sustainable development issues.

## The Impact of Population Density, Energy Consumption, Economic Growth and Trade Openness on CO2 Emissions In India

As the world's third largest carbon dioxide (CO2) emitter, India has long been believed to mostly compromise with international environmental obligation. Using annual data for the period 1970-2013, the study investigates the impact of population density, energy consumption, economic growth and trade openness on CO2 emissions in India. It applies the autoregressive distributed lag bounds testing approach to cointegration for establishing the existence of a long-run relationship and uses vector error correction model to determine the direction of causality between the variables. The results indicate that there is a meaningful long-run relationship between CO2 emissions and socioeconomic factors. We find that population density, energy consumption and economic growth have statistically significant positive effect on CO2 emissions both in the short-run and long-run. Among these three drivers, population density proves the main influencing factor of CO2 emissions changes. Therefore, a cautious population stabilization policy in the country would assist in reducing CO2 emissions and sustaining long-run economic growth. The findings further support the continued policy actions to develop the alternative energy sources such as renewable, and to use green and clean technologies to curb CO2 emissions without reducing energy consumption.