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The impact of air-railways transportation, energy demand, bilateral aid flows, and population density on environmental degradation: Evidence from a panel of next-11 countries

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ABSTRACT

Transportation considers the highly volatile sector that deteriorates the environment with carbon dioxide (CO₂) and greenhouse gas (GHG) emissions. Such emissions are not only responsible for climate change, but also escalate the natural resource rents that are mediated with national scale economic indicators to diffuse the sustainability agenda across the globe. This study mainly focused on air-railways transportation, energy demand, bilateral aid flows, population density and environmental degradation in a panel of Next-11 countries, for the period of 1975–2015. The results confirmed the existence of environmental Kuznets curve (EKC) for air-railways passengers carried and per capita income with CO₂ emissions, while there is a U-shaped relationship between railways passengers carried and GHG emissions. The monotonic increasing relationship of air transport passengers carried and bilateral aid flow is established with the natural resource rents. Railways goods transported, energy demand, and population density escalates CO₂ emissions, while energy demand and population density further increase GHG emissions. The air transport freight has a positive relationship with the GHG emissions and negative relationship with the natural resource rents in a panel of countries. The causality estimates confirmed the bidirectional relationship of environmental factors and railways transportation with the per capita income, while there is a unidirectional causality running from energy to bilateral aid and growth. The results of variance decomposition analysis show that air transport passengers carried, energy demand, and bilateral aid is the key predictor that will largely influence CO₂ emissions, GHG emissions, and natural resource rents, for the next ten year period.

1. Introduction

The economic and environmental impacts of transport sector is crucial for broad-based economic growth, as it is chiefly attributed with unsustainable growth paths, as we are consuming global energy is nearly about 20% and around one-fourth energy induced carbon emissions that is projected to likely increase 50% by 2030 and additionally incremented 30% expected in 2030 makes it around 80% by 2050. This impact is obviously alarmed for future sustainable policies, which indicates the vulnerable impact on

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natural environment in a form of climate change and global rise in GHG emissions (IEA, 2009).

In 2005 Goldman Sachs mooted the BRIC successors, known as the Next-11 countries, which comprises the set of different countries including developed country (South Korea), newly industrialized countries (Indonesia, Iran, Mexico, the Philippines, and Turkey), and developing countries (Bangladesh, Egypt, Nigeria, Pakistan, and Vietnam). The Next-11 countries enjoyed a large growing population base which enhanced its consumer market and attract the domestic and foreign firms to invest in the economy by reaping economic profits (Eghbal, 2008). Transport associated carbon emissions is one of the mounting concern in the Next-11 countries, which is seriously threaten the climate change and global warming situation that need to be addressed as per the concerns of Intergovernmental Panel on Climate Change (IPCC, 2014), which indicated the overwhelming increase of direct transport carbon emissions by 2050 if aggressive and sustained policy interventions not been made in the global environmental agenda. The improvement in air quality indicators is the desirable solution to reduce the threat of climate change impact on economic growth, while it is further need to search the desirable renewable energy sources that less sensitized with the carbon emissions. The Next-11 countries should follow the path of energy conservation and cleaner production techniques to improve global environment (Shahbaz et al., 2016).

There are number of sources that overwhelming increase transport associated carbon emissions and their resulting impact on global climate change and GHG emissions i.e., (i) the growth of private vehicles that considerably affect the oil demand and its prices, which further leads to GHG emissions (Yan and Crookes, 2009); (ii) highway fuel consumption, crude oil and petroleum products, conventional sources of energy intensive fossil fuel consumption, and purchase tax credits for new vehicle purchase, all leads to GHG emissions (Morrow et al., 2010); (iii) rapid economic growth and vehicle ownership considerably increase CO₂ emissions (Lu et al., 2007); (iv) truck freight intensification of CO₂ emissions (Kamakate and Schipper, 2009); (v) logistics activities based emissions including freight demand and truck fuel consumption (Piecyk and McKinnon, 2010); (vi) freight transport operations increases high tons carbon emissions (McKinnon, 2007); (vii) road transportation consumed gasoline and diesel more faster than any other sector that largely linked with GHG emissions (Ong et al., 2012), etc. These are the main predictors that affect largely environmental sustainability agenda by transport emissions across the globe.

He et al. (2005) pointed out that oil consumption increases due to road transportation demand in China while it is imperative to proposed sound policy measures to improve motor vehicle design that will give large oil saving benefits to the country. Ramachandra (2009) concluded the fact that trade liberalization and government policies considerably increases the road vehicles in different states of India, which considered the potential determinants of GHG emissions, while the crucial fact is that Maharashtra's state largely contribute to 11.8% of road vehicle emissions, followed by Tamil Nadu about 10.8%, Gujarat about 9.6%, Uttar Pradesh about 7.1%, Rajasthan about 6.22% and, Karnataka is about to 6.19%. These statistics firmly indicates the road transport emissions which is the serious concern of India's energy and environmental reforms, which required sound policy vista for sustainable transportation agenda at countrywide. Timilsina and Shrestha (2009) identified different national scale indicators that affect the transport associated carbon emissions in the selected Asian countries and found that, in general, rapid changes in economic growth, population, and energy intensified transportation sector are the main predictor that influences transportation emissions. The study proposed number of policy measures to reduce transportation sector emissions including tax structure, government expenditures and subsidy programmes, renewable energy sources, less carbon intensified fuel consumption, etc. These measures would helpful to reduce the threat to climate change and global warming, which further for promoting sustainable transportation across the globe. Liaquat et al. (2010) presented the importance of biofuels consumption as a means of using transportation fuel, which is less sensitive to the carbon emissions; while it is easier for its production for developing countries that have strong agricultural setups from energy crops. On the other way around, higher growth in the urban population and strive hard to progression in economic growth of developing countries, the carbon mitigating policies are not an easy task for their policy planners. It is suggested that the road transportation emissions substantially may reduce by adopting biofuels production in biofuel operated automobiles in this region. Lin (2010) emphasized the need of public transport use that set it out for reaching to the tourists destinations and it would helpful to reduce energy demand and transport associated carbon emissions. Mao et al. (2012) proposed different policy options to reduce transport sector CO₂ emissions including fuel tax and energy taxes, however, it is necessary to set the tax rates that helpful to achieve this mitigation target at nationwide.

Geng et al. (2013) concluded with some possible solution to the gradual phase-out of inefficient vehicles i.e., purchase of green vehicles, infrastructure improvement and capacity-building initiatives. Uusitalo et al. (2013) emphasized the need of efficient energy use that helpful to reduce GHG emissions from the transport sector. The renewable energy sources played a pivotal role to reduce GHG emissions that resulted into minimize the threat of climate change. The study recommended for the use of biogas in the electric cars and/or gas operated cars for transport sustainability. Chandran and Tang (2013) investigated the long-run relationship between transportation induced energy demand and carbon emissions in selected ASEAN countries and found a positive impact of transport energy and economic growth on CO₂ emissions, which leads to the conclusion of transport sustainability that is possible only to independent with the use of fossil fuel energy and use of energy efficient transportation technologies for improving natural environmental quality. Abdallah et al. (2013) investigated the non-linear relationship between transport emissions and transportation growth in Tunisia and found an inverse N-shaped relationship between them. This result does not establish the inverted U-shaped relationship; therefore, it is suggested to device sound policy framework for transportation sustainability in the better interest of economic and environmental agenda. Saboori et al. (2014) examined the relationship between road transportation induced energy, economic growth and carbon emissions in a panel of OECD countries and found a feedback relationship between them. In addition, the impulse response function shows differential policy shocks in terms of larger and relatively shorter responses between the variables for the next ten year period. The study concluded with the fact that road transportation energy consumption should be shifted to the renewable energy sources including power energy and biofuel consumption to mitigate global GHG emissions.

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