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Does private investment in the transport sector mitigate the environmental impact of urbanisation? Evidence from Asia

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ABSTRACT

Urbanisation serves as a pillar for creating prosperous economies, but its impacts on infrastructure and the environment have been a concern for policy makers. There are numerous studies that examine the impact of urbanisation on the environment but no known study has analysed whether the impact of urbanisation on the environment is dependent on the characteristics of available infrastructure. To address this gap, this study uses the STIRPAT model, panel cointegration and fully modified ordinary least square (FMOLS) estimator as well as panel data of eight Asian countries to analyse whether private sector investment in the transport sector and transport infrastructure mode influences the impact of urbanisation on transport CO_2 emissions. We find that the effect of urbanisation on transport CO_2 emissions depends on the covariates in the model and interactions with other factors. Increase in income and population increases transport CO_2 emissions while technological improvements reduces CO_2 emissions from the transport sector. Private sector investment in the transport sector and availability of rail infrastructure reduce transport CO_2 emissions; and given the same level of urbanisation, Asian countries with more rail infrastructure and private sector investment in the transport sector tend to have lower CO_2 emission from the transport sector. Policy makers in Asia should make efforts to boost private sector participation in the transport sector and also promote the construction and improvement of rail infrastructure in order to reduce urbanisation-induced transport CO_2 emissions.

1. Introduction

The impressive economic growth of Asian economies in the past few decades, dubbed as the Asian miracle, has attracted attention globally and has been identified as a potential development pathway for other developing countries to follow (Chang, 2006; Lee et al., 2008). Over the past decades, Asian countries like China, Singapore, Korea, Malaysia and Taiwan have experienced considerable economic growth that enable them to place vast proportion of their population above the poverty line. For instance, GDP per capita (purchasing power parity) increased from 1990 to 2014 by 1248%, 300%, 273% and 169% in China, Korea, Singapore and Philippines respectively. Similarly, poverty and unemployment rates fell substantially in the region compared to other developing regions like sub-Sahara Africa. Other social and human development indicators such as under-five mortality, maternal mortality rates, institutional development, literacy rates, etc showed considerable improvements compared to their levels in the 1980s (UNDP, 2007). However, the improved economic performance and development also created some new challenges such as high urbanisation rates and environmental degradation (Jedwab and Vollrath, 2015; Martinez-Zarzoso and Maruotti, 2011).

Urbanisation rates increased rapidly in Asia more than any other region has ever experienced (UN-Habitat, 2013). The positive effects of urbanisation in Asia are documented in the literature (Browne, 2014). Yap and Thuzar (2012) suggest that cities in South-East Asia drive economic growth, supported by state investments in infrastructure, research and development and industrial clusters. This positive link between urbanisation and economic growth is also affirmed by Turok and McGranahan (2013). Cali and Menon (2009) analyse the impact of urbanisation on rural poverty in India, and find that the effect is positive but not strong. On the contrary, the negative impacts of urbanisation are also identified. UN-Habitat (2013) states that the Asia-Pacific region is urbanising faster

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than any region in the world had ever done; and is increasingly accompanied by urban poverty, limited access to basic services, vulnerability and environmental degradation (Kundu, 2009). Hilderbrand et al. (2013) also associate rapid urbanisation in the Asia-Pacific region to low-quality and unsafe employment and high inequality level. Kraas (2007) emphasises the environmental problems associated with urbanisation, such as air and water pollution, waste disposal, ecological degradation, etc.

Environmental degradation in the region has increased significantly. According to the World Development Indicator, the CO_2 emissions per capita of the East-Asia and Pacific region rose by over 400% between 1960 and 2011, driven largely by China. As a whole, Asia currently has the highest level of CO_2 emission in the world; and CO_2 emissions from the combustion of fossil fuels are the major contributor to climate change. Thus, the increasing global attention and priority on environmental sustainability, especially in the aftermath of the Paris climate conference and adoption of the sustainable development goals (SDGs), has necessitated the need for the mitigation of environmental degradation globally and particularly in Asia.

One of the major challenges associated with urbanisation is the increased requirements for physical infrastructure such as transport, energy, water, and sanitation (Martinez-Zarzoso and Maruotti, 2011; Sadorksy, 2013). According to a recent research, there is a $4.1–4.3 trillion annual investment gap between existing and required urban infrastructure (CCFLA, 2015). The demand for transport infrastructure in particular is significantly related to increasing urbanisation rates. Urbanisation drives mobility and transportation by increasing the demand for motorised traffic in urban centers, and between rural and urban areas. Given urbanisation levels, urban infrastructure will play an important role in determining the future of the climate. The transport sector is currently the second largest source of CO_2 emissions after the energy sector. According to the IEA (2014), the transport sector emitted 7.34 billion tons of CO_2 in 2013, which is equivalent to 23% of global CO_2 emission, and the level is expected to reach 9.3 billion tons by 2030. Meanwhile, urban transport infrastructure investments determine its features, including whether it is climate-friendly or vulnerable; and achieving sustainable urban development requires long-term planning, substantial investment and priority for low-emission intensity and climate-resilient transport infrastructure. Thus, it is imperative to study the impact of urbanisation on transport CO_2 emissions with special focus on the mode of transport infrastructure and financing. This is the primary objective of this study.

Numerous studies have been conducted on the impacts of urbanisation on the environment, specifically pollution and CO_2 emissions (Abesamis et al., 2013; Al-mulali et al., 2013; Al-Mulali et al., 2015; Xu and Lin, 2015a, 2015b, 2015c). Similar studies have investigated the determinants of CO_2 emissions (Dogan and Seker, 2016a, 2016b, 2016c; Jebli et al., 2016). But there are limitations in the literature that this study intends to address. The main contributions of this study to the literature are in two folds. First, we estimate the impacts of urbanisation on CO_2 emissions of the transport sector in Asia. From a careful review of the literature and to the best of the authors' knowledge, empirical studies that investigate the impacts of urbanisation on transport CO_2 emissions for the entire Asia are rare. Past studies like Hossain (2012), Kamal-Chaoui et al. (2011), Lin and Xie (2014a), Tang et al. (2015) only examine the impact of urbanisation on transport CO_2 emission in individual Asian countries, and mostly in China. Timilsina and Shrestha (2009) analyse transport CO_2 emissions in a number of Asian countries but exclude urbanisation from the explaining variables. This present study uses a panel data of eight Asian countries which include China, India, Malaysia, Thailand, Pakistan, Philippines, Vietnam and Indonesia. The selection of these countries is determined by data availability. Second, we investigate the impacts of the nature of transport infrastructure mode and investment on CO_2 emissions in the transport sector. This is the first known study to extend the literature to these fronts. In addition, we analyse whether the impacts of urbanisation on transport CO_2 emissions depend on the mode of transport infrastructure and the source of investment. Various studies have found that the impact of urbanisation partly depends on the level of development (Ke and Lin, 2015; Martinez-Zarzoso and Maruotti, 2011). But we posit that the impact may also be related to the mode of transport infrastructure and investment. The result is useful for policy makers on the appropriate policies to pursue to mitigate the environmental impacts of urbanisation vis-à-vis optimal transport infrastructure mode and investment structure.

In addition, we adopt a demonstrated analytical framework and recently developed estimation technique. We analyse the relationship between urbanisation and transport CO_2 emissions using the STIRPAT analytical framework, panel cointegration and fully modified OLS (FMOLS) estimator. The STIRPAT model is an important analytical tool for analysing the drivers of environmental changes, and it is useful for hypothesis testing unlike the IPAT and ImPACT models (Fan et al., 2006; York et al., 2003). The FMOLS estimator is used to estimate the coefficients of the impacts of urbanisation and the other variables on transport CO_2 emissions in Asia. This estimator is superior to conventional panel data estimators because it corrects for endogeneity and serial correlation in the model (Kao and Chiang, 2000; Pedroni, 2000). The panel cointegration and FMOLS are suitable for the analysis because they examine the long run relationship between the variables and estimates the coefficients of these variables. This is important given that the expected impacts of urbanisation and other economic factors on the environment are in the long run. These methods generate more reliable estimates of the impact of urbanisation and other variables on transport CO_2 emissions because they address endogeneity and serial correlation problems which are likely to undermine the results. Thus, the main objective of this study is to examine the relationship between urbanisation, rail transport infrastructure, and private sector investment in the transport sector and transport CO_2 emissions in Asia. The specific objectives are as follows:

(i) To analyse the impacts of urbanisation on transport sector CO_2 emissions in Asia
(ii) To determine whether the impacts of urbanisation on transport sector CO_2 emissions depends on the transport infrastructure mode and private sector investment in the sector.

The paper finds that the effect of urbanisation on CO_2 emissions from the transport sector depends on the variables in the model and the interactions of urbanisation with other factors. Increase in income and population also lead to increase in transport CO_2 emissions while technological advancement reduces transport emissions. Private sector investment and development of rail transport system also lead to reduction in transport CO_2 emissions. Given the same level of urbanisation, transport CO_2 tends to be lower in Asian countries with more rail infrastructure and private sector investment in the transport sector. The remainder of the paper is as follows: Section two reviews the relevant literature on urbanisation and the environment. The method of analysis and the analytical framework are the focus of section three. Section four presents and discusses the results of the empirical analysis while chapter five is the conclusion and policy implications of the study.

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