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Relative improvements in road mobility as compared to improvements in road accessibility and economic growth: A cross-country analysis

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ABSTRACT

Previous studies indicated that an increase in road length had a positive and statistically significant impact on economic growth. However, the demand for and development of highly mobile or highly accessible roads likely varies according to the level of economic development, and this might have a significant influence on economic growth. The objectives of the present study were twofold: 1) to evaluate how road infrastructure growth facilitates export-led growth processes and 2) to determine the investment level needed for different road types to facilitate economic and commercial activities at different developmental levels. To shed light on these issues, fixed-effects linear regression analysis was conducted using time-series cross-sectional data on the relative improvement in road mobility as compared to improvement in road accessibility (MPA) and economic growth for 60 countries over the period 1980–2010. The key finding of this study was that in countries with a medium and high level of development, improvements in road mobility facilitated export-led growth. This indicates that policies to promote export should be implemented in conjunction with high-mobility road network expansion to enhance economic growth, particularly in countries with a medium level of development, which generally suffer from lower levels of high-mobility road network development. Such expansion in road mobility is necessary to fulfill demands for long-distance travel and enable the transportation of goods and services across regions, thereby facilitating productivity and trade. On the other hand, in countries with a low level of development, more investment is required to build roads with higher accessibility. Such roads are required to facilitate local business and trade activities. This type of road development is necessary to achieve sustainable economic growth in these countries.

1. Introduction

Agglomeration economies refer to the spatial concentration of economic activities in a region where economic agents and individuals benefit from being close to each other (Marshall, 1890; Rosenthal and Strange, 2004; Blakely and Leigh, 2010). Various reasons have been put forward to explain the benefits of clustering economic activities. These include reduced goods transportation costs (Krugman, 1991), availability of local skilled labour and raw materials (Marshall, 1890), and increased knowledge creation and spill overs (Jacobs, 1969; Duranton and Puga, 2004). The expansion of road infrastructure networks leads to improved transportation and delivery of goods and services. This can catalyse the development of agglomeration economies by providing channels for sourcing, delivering, and distributing events, thereby reducing transportation times and contributing substantially to industrialization and economic growth (Henderson and Thisse, 2004; Brülhart and Sbergami, 2009; Konishi, 2000; Lin and Truong, 2012; Rode et al., 2014).

Roads can be classified according to their level of mobility and accessibility. Roads with higher mobility, such as motorways, provide limited access but largely uninterrupted travel with high speeds, thus improving travel time reliability for transporting goods and services. Roads with higher accessibility, such as local roads, provide limited mobility but offer more direct routes to specific destinations. Such roads generate potential for human interactions and opportunity for socio-economic activities.

The level of road mobility and accessibility needed to sustain economic growth varies considerably at different developmental levels. On the demand side, at lower levels of development, the population is concentrated in smaller areas, and business activities mainly occur at the local scale. Therefore, there is more demand for short-distance travel for

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delivering goods and services. However, as the economy grows and the population increases, urban sprawl occurs, with residential and commercial facilities located in the suburb. The latter contributes to automobile dependency and increases the need for more long-distance travel. On the supply side, at lower development levels, the scale of economic activity is small, limited and less varied in scope. Therefore, more government investment in local roads is needed. At higher development levels, policy makers need to invest more resources to build higher mobility roads, which are required to facilitate productivity and trade, thereby sustaining higher economic growth. Thus, in the presence of scarce resources, the decision to build roads with higher mobility or higher accessibility based on a country's development level may have a significant effect on economic growth.

Economic theory suggests that the expansion of export-oriented industries leads to significant economic growth (Bernard and Jensen, 1999; Aw et al., 2000; Van Biesebroeck, 2006; De Loecker, 2007) because export growth can link local markets to international markets, which are almost limitless. Thus, there are no growth restrictions on the demand for goods (Helpman and Krugman, 1985; Esfahani, 1991; Easterly, 2007; Siliverstovs and Herzer, 2007). Economic growth driven by export also contributes to the creation and dissemination of knowledge and skills, which consequently enhance the productive efficiency of manufacturing industries (Bhagwati, 1988). Export-led growth cannot be realized without adequate improvements in road infrastructure, including mobility.

Previous studies[1] indicated that increases in road length and improvements in road facilities contributed positively to economic growth. However, a number of gaps remain in the literature. First, the demand for and supply of roads likely varies according to the level of economic development. The verification of this hypothesis would help to determine the investment level needed for different road types and thereby facilitate different levels of economic and commercial activities. Second, it is important to understand how road infrastructure growth facilitates export-led growth processes. This knowledge would shed light on the necessity and benefits of implementing export-led growth policies alongside with road infrastructure development policies to achieve a sustainable economic growth. Thus, the objectives of this study were to 1) evaluate how road infrastructure growth facilitates the export-led growth processes and 2) determine the investment level needed for different road types to facilitate economic and commercial activities at different developmental levels.

The rest of this paper is organized as follows. Section 2 reviews the literature on the relationship between road infrastructure development and economic growth. Next, we describe the data and variables use in the study. In Section 4, we discuss the estimation methodology applied to estimate the economic growth, followed by results and discussions in Section 5. Finally, we present the conclusion of the study and also the directions of the future research in Section 6.

2. Road infrastructure development and economic growth: a review of the literature

Historically, the development of road infrastructure and economic growth has been interrelated, with the two factors influencing each other. The provision of road infrastructure stimulates the movement of people and goods, improves access to markets, and reduces transportation times and costs. The greater accessibility (e.g., to health care services, education centers, credit facilities, and potential employment) and mobility enabled by road infrastructure development results in more economic growth, which drives the supply and demand for improvements in infrastructure through higher motorization and goods transportation rates. Therefore, the development of road infrastructure is generally considered vital to achieve a sustainable society and economic growth. Although the majority of empirical studies on road infrastructure development and economic growth indicated that road infrastructure development appeared to have positive effects on economic growth,[2] some studies reported a zero or negative relationship between road infrastructure development and economic growth.[3]

In terms of positive outcomes in developed countries, several studies in the United States (U.S.) concluded that the development of the interstate highway after World War II contributed positively to economic growth (Friedlaender, 1965; Keeler and Ying, 1988; Boarnet, 1997; Fernald, 1999; Mamuneas and Nadiri, 2006). According to one study, the development of the interstate highway made a positive contribution to economic growth by creating an efficient connection between states that previously did not exist. Although this positive effect declined in later decades after World War II, the highway continued to contribute positively to economic growth. In a cross-sectional study, Nadiri and Mamuneas (1998) analyzed the contribution of highway capital to productivity and output growth in the U.S. from 1950 to 1991 and reported that the output elasticity of the interstate highway was an average of 0.08%. According to Nadiri and Mamuneas (1998), an increase of 1% in infrastructure development increased the gross domestic product (GDP) of the U.S. economy by 0.08% percent. Crafts and Leunig (2005) demonstrated that road development increased both national and international economic activity and trade during the 1950s and 1960s, with the highway infrastructure accounting for one-third of all productivity growth in the U.S. However, by the 1980s, this contribution had fallen to 4% (Crafts and Leunig, 2005).

Using the standard Cobb-Douglas type production function, a number of studies demonstrated that the development of road infrastructure contributed positively to production in developing countries (Fan et al., 2002; Canning and Bennathan, 2000; Canning and Pedroni, 2004; Fan and Chan-Kang, 2008). Based on an analysis of provincial-level data from 1982 to 1999 in China, Fan and Chan-Kang (2008) demonstrated that road development in this period contributed positively to economic growth and poverty alleviation. An interesting finding in the study was that the contribution of low-quality roads, especially rural roads, to national GDP was four times greater than that of high-quality roads. The authors of the study explained that the greater contribution of low-quality roads was due to higher marginal returns on investments in these roads. In Sri Lanka, based on a survey of various industries in 1990 and 2000, Gunasekera et al. (2008) concluded that investment and improvements in highway projects led to increases of 70% in the outputs of industries located within 10 km of highway facilities and increases of 60% in those located more than 10 km from these facilities. Aschauer (2000) examined the impact of gross public investment, including investment in highway infrastructure, on the economic growth of 46 low- and middle-income countries from 1970 to 1990. The study found that efficient use of public capital in these countries contributed positively to economic growth. Canning and Bennathan (2000) investigated the social rate of return of paved roads in 41 countries in the period 1960–1990. The study revealed that countries with a shortage of paved roads contributed to the highest social rates of return as compared to other countries. It also revealed that the length of paved roads was strongly correlated with human and physical capital and that the marginal return on roads declined abruptly when the length of paved roads increased in isolation from physical and human capital. Based on a 15-year longitudinal household dataset from Ethiopia, Dercon et al. (2009) found that improvements in road quality enhanced access to agricultural extension services, which resulted in an

[1] See Boarnet, 1997; Fernald, 1999; Crafts and Leunig, 2005; Gunasekera et al., 2008; Fan and Chan-Kang, 2008 and Zhang, 2013 for more details.

[2] Such as Friedlaender, 1965; Boarnet, 1997; Binswanger et al., 1987; Keeler and Ying, 1988; Nadiri and Mamuneas, 1998; Fernald, 1999; Aschauer, 2000; Canning and Bennathan, 2000; Fan et al., 2002; Canning and Pedroni, 2004; Crafts and Leunig, 2005; Cadot et al., 2006; Hulten et al., 2006; Gunasekera et al., 2008; Fan and Chan-Kang, 2008.

[3] For instance, Hulten, 1996; Jiwattanakulpaisarn et al., 2009a, 2009b and Banerjee et al., 2012.