The Long Run Association Between Transport and Economic Growth in Bangladesh: An Econometric Analysis

Sabina Yasmin[1], Asma Akter[2]

[1]Sabina Yasmin, Lecturer of Economics, Asian University of Bangladesh, Ashulia, Savar, Dhaka- 1341
[2]Asma Akter, Assistant Professor of Economics, Asian University of Bangladesh, Ashulia, Savar, Dhaka- 1341

Abstract

Public investments in transport infrastructure have been widely used by policymakers as a tool to promote economic development. Transport infrastructure investment acts as a catalyst for productivity and economic growth. This study attempted to investigate the direction of causality between transport and economic growth in Bangladesh over 22 years, from 1999 to 2021. The coefficients of parameters in a simultaneous equation model are found via multivariate analysis and the three-stage least squares method. According to the estimated conclusion, GDP drives transport expansion and transport development considerably contributes to economic growth, which is ten times GDP. But compared to the transport elasticity of growth, the output elasticity of transport is lower. Additionally, this paper also shows that transport significantly enhances exports, marketing of agricultural goods, and industrial production.

Keywords: Transport, Economic Growth, Three Stage Least Square, Multivariate analysis.

Introduction

A robust, sustainable, and efficiently designed transportation and communication infrastructure is widely regarded as the primary catalyst for attaining substantial economic expansion in any given economy. By ensuring fair produce marketing, the mobility of production means, a stable price level, and foreign investment, including regional and global transportation and communication networks, it contributes to accelerating the pace of sustainable development. Major cities, ports, and economic and industrial centers are connected to the rest of the country by roads, railroads, and waterways, particularly in the most remote areas. Several factors have contributed to Bangladesh's economy's remarkable progress over the past 20 years, but significant advancements in transportation and communication must have been a major one. Bangladesh hopes to industrialize itself into a high-income state by 2041, when a per capita income of $12,500 is anticipated. To effectively realize this objective and create progress and a thriving nation, numerous massive projects have been launched with the goal of creating world-class communication by assigning equal emphasis to the road, railway, airline, and navy.

There are three types of roads, such as national highways, regional highways, and district roads, which are maintained by the Roads and Highways Department, whereas the Local Government Engineering Department maintains upazila, union, and village roads. The total length of roads is now 37500 km,

compared to 3,600 km in 1971. 'Road leads to prosperity' has encouraged huge investments in expanding the nation's transport network and, hence, enhancing overall economic performance. In the fiscal year 2022-2023, it is worth noting that 28.7% of ADP has been allocated to the transport and communication sector. In FY2022-23, the Local Government Division (LGD) has been allocated Tk 35,842 crore from the ADP budget, from which a substantial amount is being spent on road construction, reconstruction, and maintenance through the LGED and by 13 city corporations and 329 municipalities. (Daily Star, 2022)

In accordance with Vision 2041, a plan has been made to improve transportation efficiency. All highways are to have six lanes by 2030 and eight lanes by 2041, and by 2041, rail services will be launched in every region of the nation. Dhaka-Mawa-Bhanga Expressway, Dhaka-Chittagong Highway, which is 190 km long, has been improved to four lanes; Jatrabari-Kanchpur to eight lanes; Dhaka-Gazipur-Mymensing; Dhaka-Tangail to four lanes; and Dhaka-Sylhet Highway has been undertaken to improve six lanes. From Cox's bazaar to Teknaf, a merin drive spanning 80 kilometers has been undertaken in an effort to stimulate the tourism business. The transportation and communication sector has been allotted 81518 crore tk for the fiscal year 2022-2023, compared to 72029 crore tk in the previous year. By completing all of those projects, we intend to achieve balanced growth and quick economic development.

Literature review

There are some studies that have been conducted about the relationship between transport and economic growth. Different researcher focused on different issues of transport and economic growth. According to Literature review, Economic growth leads to the growth in road transport, while in the case of the rail transport, neither economic growth nor rail transport effect each other. But air transportation leads to economic growth with feedback. (Abayomi A., et al, 2018). Transportation investment in one province not only promoted economic growth in that province but also had external effects on neighboring provinces. (Mikesell J.L., et al, 2015). Transportation infrastructure has a long-run promoted effect on economic development. However, in the short run, this effect turns out to be significantly negative. Differentiated roles that the UK's transport infrastructure played in economic growth, which should be considered in future policy design of achieving economic sustainability in the UK.(Zhang Y.,et al,2023). Transportation is a leading indicator. Nearly all facets of business deal with transportation in some way, so it is reasonable that changes in this sector might predict changes in the overall economy. (Alagic A.,2017). Road and air transports have significant positive contribution to economic growth in the long-run while rail transport is insignificant. (Ghosh, et al, 2019). The existence of the bi-directional causality relationship between economic growth and freight transport in lower income countries indicates that the transport activities have the important role in economic activities. The transportation plays an important role in the distribution of goods. In contrast, the relationship between the economic growth and the freight transport in high-income countries shows a negative causality. The bi- directional causality between the economic growth and the CO_2 emission in lower-middle income countries show that developments in this countries group do not pay attention to the environmental quality. (Listiono, 2018). Development, diversification and development of the transport system had as a cause expansion and intensification of production and circulation of goods. Investment in transport infrastructure is a tool for regional development, especially in developing countries, mainly for the road sector. (Nistor F., et al, 2014). Both for 1970 and 2008, only well developed economies clearly show bi-directional causality

between GDP and transportation. In contrast, no such clear tendency can be seen in other countries, which exhibit mixed results, indicating a strong linkage between the level of development and transportation. (Beyzatlar M.A., et al, 2012). There was a strong statistically significant relationship between GDP and transport sector as measured by transport services for both short run and long run as it is shown by R-squared of 0.997316 and 0.782009 of the long run regression model and error correction model respectively.(Ntamwiza J.M.V., 2020). There is no causality from capital transport infrastructure expenditure, government revenue, and exchange rate to economic growth in Nigeria while short-run causality existed from recurrent transport infrastructure expenditure to economic growth in Nigeria.(Badiru A., et al, 2023). The growth in road length as proxied by road sector expenditure contributed positively to economic growth in both short-run and long run. The expansion of road transport infrastructure will lead to substantial growth of the Kenya economy though gross capital formation.(Mose N., 2022). The more travellers are carried by air transport, the more that economic growth will increase. Additionally, negative shocks of air transport have a stronger detrimental impact on economic development than positive shocks (Khanal, A. 2022) .

According to the examined empirical literature, there is a mixed picture of the relationship between economic growth and investments in transportation infrastructure reported by various empirical researches, with some findings remaining equivocal. These studies are important, yet they have methodological flaws, bias from missing variables, or issues with the data. The current work improves upon the previous research by resolving the aforementioned issues and using the three-stage least squares approach for fully described error. While some of the studies report a positive relationship between transport and economic growth in the long run, others report a negative relationship in the short run. A few studies have tried to show bi-directional causality between GDP and transportation. A small number of research attempted to highlight the positive correlation between economic growth and road transportation, but they found a negative correlation between economic growth and rail and air transportation. The three-stage least squares approach was not used in any of the research to demonstrate the long-term correlation between Bangladeshi transportation and economic growth. The goal of this study is to determine whether transportation and economic growth in Bangladesh are related over the long run. The article's remaining sections are arranged as follows: Initially, the goals of the research will be outlined. Subsequently, the study's research methodologies and approaches will be examined. The results of our study will then be discussed. In conclusion, the managerial implications and limitations of the study and directions for future research will be presented.

Objective:

Examining the long-term relationship between transportation and economic growth in Bangladesh is the main goal of this study. The following is a list of the study's particular goals:

1. To identify the bidirectional causality between transport and economic growth.
2. To demonstrate the extent of influence of transportation to other important sectors in the economy.

Methodology

The long-term relationship between Bangladesh's economy and transportation is the subject of this study's investigation. For this analysis, secondary sources of data were gathered from economic review of different years from 1999 to 2021. In order to demonstrate the long-term correlation between GDP

and transportation, exogenous variables such as agriculture industry, investment, and export have also been included.

Research Hypotheses

The hypotheses designed for this study are stated as follows:

H_0 : There is no causal relationship between transport and other sectors

H_1 : There is causal relationship between transport and other sectors

As it is a simultaneous equation model[1], if OLS is applied, the estimators are not only biased but also inconsistent. The most efficient estimation method for simultaneous equations is three stage least squares[2] .We have adopted one techniques to measure the accuracy of forecast by the 3SLS, namely serial correlation. To ensure the validly of our hypothesis and make the parameters of 3SLS more accurate, serial correlation must be checked. In the autocorrelation[3] test, the null hypothesis is that there is no autocorrelation of each equation in time.Multivariate analysis[4] has been used to show contribution of transport to another important sector. All the tests mentioned have been run in STATA15 software packages

The Models specification

In an attempt to examine, transport led growth. Transport is a function of GDP, agriculture, industry, investment and export.

TPT= f(AGRI,GDP,IND,INVT,EXPT)

GDP=f(AGRI,GDP,IND,INVT,EXPT)

Where TPT=Transport, GDP =gross domestic product, AGRI=agriculture, IND= industry,

INVT=investment and EXPT= export

Simultaneous equation

$$TPT_t=\beta_0+\beta_1 AGRI + \beta_2 GDP +\beta_3 IND+\beta_4 INVT+\beta_5 EXPT+\varepsilon_t \text{——————— (1)}$$

$$GDP_t=\beta_0+\beta_1 AGRI + \beta_2 TPT +\beta_3 IND+\beta_4 INVT+\beta_5 EXPT+\nu_t \text{——————— (2)}$$

Where TPT and GDP are mutually dependent, or endogenous, variables and AGRI, IND, INVT AND EXPT are exogenous variables and ε_t and ν_t are the stochastic disturbance terms.

$$\varepsilon_t=\delta_0+ \delta_1 \varepsilon_{t-1} + \delta_2 \varepsilon_{t-2}+\text{------------------------(3)}$$

$$\nu_t =\mu_0+\mu_1 \nu_{t-1} +\mu_2 \nu_{t-2}+ \text{---------------------(4)}$$

---

[1] Simultaneous equations models are a type of statistical model in which the dependent variables are functions of other dependent variables, rather than just independent variables.

[2] The term three-stage least squares (3SLS) refers to a method of estimation that combines system equation, sometimes known as seemingly unrelated regression (SUR), with two-stage least squares estimation. It is a form of instrumental variables estimation that permits correlations of the unobserved disturbances across several equations, as well as restrictions among coefficients of different equations, and improves upon the efficiency of equation-by-equation estimation by taking into account such correlations across equations.

[3] Autocorrelation refers to the degree of correlation of the same variables between two successive time intervals. It measures how the lagged version of the value of a variable is related to the original version of it in a time series. Autocorrelation, as a statistical concept, is also known as serial correlation.

[4] Multivariate analysis (MVA) involves evaluating multiple variables (more than two) to identify any possible association among them. Key takeaways: Multivariate analysis offers a more complete examination of data by looking at all possible independent variables and their relationships to one another.

Findings of this Study

Table1: serial autocorrelation of equation 3

Lag of residual	coefficient	P value
1	.360	0.59
2	-2.282	0.074
3	-1.098	0.322
4	-1.126	0.33
5	-.467	0.221
6	-1.108	0.073
7	-.755	0.169
8	-.788	0.146
9	-.205	0.455
10	-.427	0.177

Table 2: serial autocorrelation of equation 4

Lag of residual	coefficient	P value
1	-.197	0.814
2	-.423	0.825
3	.233	0.925
4	-1.32	0.582
5	.059	0.977
6	-.218	0.925
7	-1.08	0.55
8	.364	0.837
9	-.372	0.846
10	-.871	0.59

In the case of the autocorrelation test, 10 lags have been selected according to AIC. A high p value (greater than 10%) in Table 1and Table 2 indicated that the null hypothesis is accepted, meaning that there is no autocorrelation, which is the precondition of applying the three-stage least squares. The error in one period is not correlated with the error in other lag periods.

Table: 3 Three stage least square (Transport as a exogenous)

Endogenous	coefficient	P value
AGRI	0.8738	0.002
GDP	9.95	0.002
IND	1.914	0.001
INVT	2.93	0.001
EXPT	0.012	0.004

Table 3 clearly shows the significant impact that transportation development has on GDP, industries, export, investment, and agriculture. The coefficient of GDP (9.95) indicates that gross domestic product

is accelerated by 10 times with any development in transport. Hence, it is highly significant. Moreover, investment is also positively influenced by improvements in transport. Besides these, there is a relationship between transports and other variables.

Table:4 Three stage least square (GDP as a exogenous)

Endogenous	Co-efficient	P-value
AGRI	0.089	0.00
TPT	0.03	0.002
IND	0.182	0.00
INVT	0.279	0.00
EXPT	0.001	0.00

Table 4 demonstrates that transport is also positively influenced by GDP, which is statistically significant. But comparing tables 3 and 4, it is pretty apparent that GDP cannot influence transport as much as transport influences GDP. It is suggesting that there is bidirectional causality between transport and GDP. In addition, investment is also confidently stimulated by GDP, which is statistically significant. Furthermore, agriculture, industries, and exports are also completely affected by GDP.

Table:5 Multivariate analysis (Trasport as independent variable)

Dependent variable	Co-efficient	P-value
AGRI	0.8738	0.009
GDP	9.95	0.007
IND	1.914	0.004
INVT	2.93	0.004
EXPT	0.012	0.012

Tables 3 and 5 show that almost the same result has been achieved in 3SLS and multivariate analysis when transport has been taken as an exogenous variable. In multivariate analysis, other variables such as agriculture, GDP, industry, investment, and exports are dependent variables. In this analysis, we have tried to show how much transport affects other important sectors of the economy simultaneously.

Conclusion:

Investing in transportation infrastructure can help to improve overall economic performance and reduce regional inequality by boosting commerce, output, and job opportunities. While transportation does make the economy more accessible, some contend that it is not the only element driving economic expansion. Bangladesh spends a significant amount of public funds on road building, renovation, and maintenance each year. The analysis shows there is bidirectional causality between transport and economic growth. It is also clear that the expansion of transportation infrastructure increases exports, investment decisions, and productivity in the industrial and agricultural sectors.

Decision-makers need to be aware that there are different effects of transport investment across regions, time periods, and sectors. The types and quality levels of transport infrastructure matter for growth

performance. Major limitations of this article include choosing 22-year intervals for analysis and not including too many variables that are catalysts for transport and GDP, such as employment and services. These would be taken into consideration for future research.

As a result, the roadways should be constructed with multiple layers in accordance with design standards and maintained with quality to withstand loads. Roads should be constructed with extra care to preserve their long-term endurance. Additionally, drains should be installed along the roads to facilitate the easy flow of water during the rainy season. During the implementation phase, a robust supervision and monitoring system should be able to guarantee that the road design is really followed. In places where waterlogging is a prevalent issue, reinforced cement concrete, or RCC, is also advised. High levels of durability on the roadways can result from the strength that nanoparticles add to cement concrete. The government ought to take note of global best practices and introduce this technology to Bangladesh.

Reference

1. Deng, T. (2013). Impacts of Transport Infrastructure on Productivity and Economic Growth: Recent Advances and Research Challenges, Transport Reviews, Volume 33, Issue 6, 2013. https://doi.org/10.1080/01441647.2013.851745

2. Ahmed, N.(2022). How to make roads more durable in Bangladesh, Daily Star, November 23, 2022. https://www.thedailystar.net/opinion/views/news/how-make-roads-more-durable-bangladesh-3177291

3. Abayomi, A., Malachy, U. and David, O. (2018). Transportation and Economic Growth in Nigeria: Cointegration and Hsiao's Causality Analysis , Bingham Journal of Economics and Allied Studies (BJEAS). Vol. 1 No. 1 JUNE, 2018.

4. Mikesell, J.L., Wang, J.Q Zhao, Z. J. and He, Y. (2015). Impact of Transportation Investment on Economic Growth in China , Journal of the Transportation Research Board, No. 2531, Transportation Research Board, Washington, D.C., 2015, pp. 9–16. DOI: 10.3141/2531-02

5. Zhang, Y. and Cheng, L. (2023). The role of transport infrastructure in economic growth: Empirical evidence in the UK , Transport Policy 133 (2023) 223–233, journal homepage: www.elsevier.com/locate/tranpol https://doi.org/10.1016/j.

6. Alagic, A. (2017). An Analysis of the Causal Relationship Between Transportation and GDP: A Time-Series Approach for the United States, Major Themes in Economics, Vol.19, Article -4,pp.17-37, Spring 2017. Available at: https://scholarworks.uni.edu/mtie/vol19/iss1/4

7. Ghosh, Kumar, P. and Dinda, Soumyananda (2019). Revisited the Relationship Between Economic Growth and Transport Infrastructure in India: An Empirical Study
Department of Economics, The University of Burdwan, August 2019 . Online at https://mpra.ub.uni-muenchen.de/116876/ MPRA Paper No. 116876,

8. Listiono (2018).The relationship between the freight transportation, economic growth and environmental degradation experienced by ninety countries, Journal of Environment and Sustainability, Volume 2 Issue 1 (2018) 11 – 23. Print ISSN: 2549-1245 Online ISSN: 2549-1253 Website: https://sustinerejes.com

9. Nistor, F., and Popa, C. (2014). The Role of Transport in Economic Development "Mircea cel Batran" Naval Academy Scientific Bulletin, Volume XVII – 2014 – Issue 2 Published by "Mircea cel Batran" Naval Academy Press, Constanta, Romania .

10. Beyzatlar, M.A., Karacal, M., and Yetkiner, I. H. (2012). The Granger-Causality between Transportation and GDP: A Panel Data Approach, Working Papers in Economics, No. 12/03, Izmir

University of Economics, Department of Economics, Izmir. This Version is available at: http://hdl.handle.net/10419/175921. DOI: 10.4236/jtts.2020.104024.

11. Ntamwiza, J. M.V.(2020). Econometric Analysis of Transport Sector on Economic Growth in Rwanda (1999-2018), Journal of Transportation Technologies > Vol.10 No.4, October 2020
Badiru, A. , Ademola, A. S. and Mutiu, A.(2023). Impact of Transport Infrastructure Expenditure on Economic Growth: Evidence From VECM in Nigeria, https://www.researchgate.net/publication/371378762

12. Mose, N.(2022). Road Transport Infrastructure and Economic Growth in Kenya , International Journal of African and Asian Studies ISSN 2409-6938 An International Peer-reviewed Journal Vol.80, 2022 .

13. Khanal, A. , Rahman, M. M., Khanam, R. and Velayutham, E. (2022). Exploring the Impact of Air Transport on Economic Growth: NewEvidence from Australia, Sustainability 2022, 14, 11351. https://doi.org/10.3390/su141811351. https://www.mdpi.com/journal/sustainability.