Scientific Research Publishing

American Journal of Industrial and Business Management, 2024, 14, 1288-1302
https://www.scirp.org/journal/ajibm
ISSN Online: 2164-5175
ISSN Print: 2164-5167

Analysis of the Impact of Transport Infrastructure on Economic Growth in the Republic of Congo

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How to cite this paper: Vinceline, P. C., Guo, S. Q., & Keeven, N. R. M. C. (2024). Analysis of the Impact of Transport Infrastructure on Economic Growth in the Republic of Congo. *American Journal of Industrial and Business Management, 14,* 1288-1302.
https://doi.org/10.4236/ajibm.2024.1410065

Received: August 28, 2024
Accepted: October 14, 2024
Published: October 17, 2024

Abstract

This study examines the impact of transport infrastructure on economic growth in the Republic of Congo. Highlighting the importance of infrastructure in development, it examines the role of roads and railways in promoting economic expansion. Despite historical challenges in infrastructure development and maintenance, recent government initiatives aim to improve connectivity. Using the Solow model, transport infrastructure is found to significantly boost economic productivity. The empirical results reveal a long-run positive correlation between transport infrastructure and economic growth and the existence of causality between infrastructure and economic growth, this study aims to establish a causal link between transport infrastructure and economic growth, providing essential information for future infrastructure projects and policies in the Republic of Congo.

Keywords

Transport Infrastructure, Economic Growth, Republic of Congo, Roads, Railways

1. Introduction

The debate on the importance of the role played by infrastructure in economic growth is not new. For economic theory, the infrastructure sector represents an important development objective not only in terms of economic growth, but also in its capacity to reduce poverty.

Bonin (2024)'s study discussed the role of transport infrastructure. According to the author, transport infrastructure, such as energy infrastructure, roads, highways and railways, played a crucial role in development, on a technical, economic

and political level. Indeed, these main lines make it possible to separate or connect environments, to form new connections with spaces, to create landscapes. They carry potential for change in our lifestyles, for collaboration between stakeholders, and for a more positive relationship between living beings and human creations. According to Abdelkader et al. (2019), infrastructure progress plays a crucial role in productivity and economic growth.

The empirical study of ARDL by Oseph Muvawala et al. (2021) revealed that investments in road transport infrastructure have significant short- and long-term impacts on Uganda's economic growth.

Regarding economic development, studies show that investments in road transport infrastructure have positive and significant long-term impacts. However, in the short term, the effect is actually not perfect. According to the work of Levoli (2019) and Nugraha (2020), economic research on infrastructure development is interesting and supports the idea that infrastructure has a symmetrical impact on economic growth.

According to the 2023 Transport Infrastructure Report, it is found that many regions of Central Africa experience road connection difficulties, with a significant proportion of the population living more than 2 kilometers from an all-weather road. Higher poverty rates and limited access to essential services such as healthcare and education are closely linked to this lack of connectivity. According to the World Bank, it is essential to invest significantly in sustainable transport solutions to foster inclusive growth and reduce economic inequality.

One of the key elements hindering Africa's economic growth, its competitive power in global markets and the achievement of its development goals, such as poverty reduction, is the lack of infrastructure.

Congo-Brazzaville has failed to establish a development plan for its road network since its independence. Furthermore, successive governments for the maintenance of these roads have made no investment. In addition to this, it is necessary to take into account the natural conditions that are not conducive to maintaining existing infrastructure in good condition.

The government of Congo Brazzaville indeed aims to build infrastructure within the country. The objective resulted in a public investment program aimed at the construction of paved roads.

Ultimately, there remains one crucial question. How can transport infrastructure have a long-term impact on the economic growth of the Republic of Congo? Before implementing new projects, it will be necessary to verify the reality of the causal link between infrastructure and economic growth, reflect on the relationship between infrastructure and economic growth and analyze what happened. However, there are few in-depth studies regarding the case of the Republic of Congo. This article aims to evaluate, using an empirical approach, the impact of the physical infrastructure of transport networks (roads and railways) on the economic growth of the Republic of Congo.

The structure of this paper is based on three sections. The first 1) presents the

state of these infrastructures in the Republic of Congo. The second 2) establishes the literature review of the theoretical link between infrastructure and economic growth, and the last 3) presents the methodology and results of the econometric estimates.

2. State of Infrastructures

In some regions, geopolitical conflicts or poor governance can impede the effective implementation of transport infrastructure projects. Corruption, bureaucratic delays, and lack of political will can slow down or derail projects, reducing their potential impact on economic development.

Since its independence in 1960, the Republic of Congo has always planned to devote large sums of money to investment in infrastructure development through various global development plans. Originally, around 5% of the roads were asphalted, but specific investments have increased this percentage to around 10% today. Despite these efforts, the road network remains insufficiently developed, with only 23,324 kilometers of lanes, a small part of which is paved. Improvements have been more significant in urban areas, but rural areas continue to suffer from inadequate connectivity. Considerable funds, often financed by international aid, have been invested in the modernization of essential infrastructure such as the Congo-Ocean railway and the port of Pointe-Noire. Energy has also been supported by investments to expand access to electricity, although many rural areas remain off-grid. It is essential to make constant efforts to resolve maintenance issues, improve digital connectivity and ensure equitable development in both urban and rural areas.

2.1. Road Network

Following independence, the road network was characterized by a preponderance of dirt roads, most of which were seasonal tracks inaccessible during the rainy season. Due to the rains, communications were very often broken between the different regions of the territory.

In 2020, the road network includes 23,234 km including 1826 km of paved roads.

Currently, the paved national road network is 3089 km 250. It is made up of 15 national roads of 5604 km, 33 departmental roads of a total of 2650 km and several rural service roads with a length of 14,980 km.

Despite this assessment of the construction of road infrastructure from 1960 to 2020, the picture remains bleak due to the realities faced by the Congolese road network today.

According to the Congolese Ministry of Equipment and Road Maintenance, "this network could have been considered relatively dense if its level of service was satisfactory".

However, most road infrastructures are not only in great precariousness but also increasingly affected by geomorphological phenomena: water erosion,

flooding and sedimentation. Indeed, this has a negative impact on the socio-economic development of rural communities and concerns both the authorities and the populations who are the main victims. The aggressiveness of the rains, the sensitivity of the geological formations, the very rugged terrain of these environments, traffic and the various actions of men are the main causes of the degradation of roads and rural tracks.

2.2. Rail Network

In Africa, railways are the least developed form of transport. The lines have a history, which is linked to that of colonization. The main purpose of railways was to transport raw materials from the center of the continent to seaports. These services were little or not used by passengers. Furthermore, the way in which the rails are gauged—UIC standard or metric—has not encouraged the traffic of goods between different regions.

The Chemin de Fer Congo Ocean (CFCO) is the only structure operating in the field of rail transport in Congo-Brazzaville. It has legal personality and financial and management autonomy. It was built between 1921 and 1934 with the objective and vocation of connecting the maritime coastline on the Atlantic Ocean to the navigable part of the Congo River. The construction was carried out starting from the two ends, namely Pointe-Noire, on the one hand, and Brazzaville, on the other hand. For the Brazzaville side, the materials constituting the railway were transported from Matadi and Kinshasa. The junction point of the two construction operations is located between Dolisie and Mont-Belo. The lack of rail connection to PAPN and the port of Brazzaville is, however, a handicap, because it does not allow direct transshipment between maritime and rail and causes a disruption in loads. CFCO's lack of willingness to use the port of Brazzaville as a freight train terminus did not allow for a volume effect capable of developing this hub.

After the infrastructure was seriously damaged during the civil war that the country experienced in 1997 leading to the cessation of train circulation, it was gradually put back into service in 1998, but it needs to be rebuilt. Traffic was again disrupted in 2016 and 2017 following the blasting of three bridges in the pool region, which took more than 2 years of work. Certain parts of the track must be replaced and many engineering structures (bridges or viaducts) require rehabilitation. Although new passenger transport cars and new locomotives were delivered in 2012 and 2015, the passenger transport activity is however neglected in favor of goods transport because it is carried out in particular with fewer safety constraints.

An attempt to concession CFCO was launched in the second half of the 1990s, but the process was declared unsuccessful. A few years later, a study was carried out for the rehabilitation of the CFCO track between Pointe-Noire and Brazzaville by the China Railways Construction Corporation (CRCC), but, ultimately, a memorandum of understanding was concluded in 2017 with a another Chinese

public company, China civil engineering (CCECC), for the same rehabilitation project, to which was added the construction of nearly 1,800 km of new railway lines to connect Pointe-Noire to Ouesso in the north, in addition of the 510 km to be rehabilitated between Brazzaville and Pointe-Noire. At the same time, the Congolese mining group SAPRO has been seeking for several years the means to rehabilitate a portion of the railway line, allowing heavy traffic, in order to evacuate its ore from the Mayoko mine, Mbinda (south-west) on the Gabon border. The Chinese company Sangha Mining Development, which in March 2021 obtained three operating permits for the iron mines of Badondo, Avima and Nabemba, in the Sangha in the far north of the country, also announced the construction of a railway line between Sangha and Kouilou for the transport of ore to Pointe-Noire, an ore port at Indian Point (Kouilou), as well as an electric transport line. The CFCO rehabilitation project was once again on the discussion agenda during the Forum on Sino-African Cooperation, held in June 2019 in the Chinese capital. For the moment, the crisis has the better of this project carried out by Chinese companies (Ministry of Transport of the Republic of Congo, 2023).

3. Literature Paper

The impact of transportation infrastructure on economic growth has continued to be a topic of intense research in recent years. Transport infrastructure (roads, railways, airports and ports) plays a crucial role in economic development by facilitating the movement of goods, services and people.

In their study, Harrison et al. (2023) examined how transportation infrastructure can contribute to economic resilience during the COVID-19 pandemic. According to the study, transport infrastructure plays a critical role in economic recovery by enabling the movement of people and goods, as well as supporting global supply chains.

The authors, Duranton and Turner (2020) and Faber (2022), aim to highlight the significant impact of transportation infrastructure on economic growth and regional development. Duranton and Turner focus on the United States, where they explore how improved highway infrastructure leads to increased local economic production, higher household incomes, and better employment rates in regions with enhanced communication routes. Similarly, Faber examines the effects of new high-speed railway lines in China, finding that cities connected by these lines experience faster GDP growth, increased foreign direct investment, and improved living standards compared to cities that are not connected. Both studies emphasize the crucial role that transportation infrastructure plays in driving economic growth, enhancing regional development, and improving overall economic well-being. According to a study carried out by Holl and Ramos (2023) on the impact of transport infrastructure on the productivity of ports in Spain, it was shown that improvements in port capacities led to a significant increase in the productivity of local companies by reducing transport costs and improving access to international markets.

Gibbons et al. (2021) uses difference-in-difference models to assess the impact of new transport infrastructure in the UK. The authors show that investments in transport infrastructure significantly improve regional accessibility and economic productivity

Cernaian et al. (2021) convincingly argue that transport infrastructure, particularly road and rail, significantly boosts economic productivity in Eastern Europe by reducing transport costs and improving market access, consistent with existing literature on the positive impacts of infrastructure on economic performance. Similarly, Gonzalez et al. (2023) offer a more nuanced view, demonstrating how transport infrastructure can reduce economic disparities by increasing access to opportunities for disadvantaged populations, thereby increasing their potential for inclusive growth. However, they also highlight that these benefits are not evenly distributed, raising the question of whether transport infrastructure alone can reduce inequality or whether complementary policies—such as investments in education, healthcare, and skills training—are needed to ensure widespread economic benefits. Furthermore, the study highlights the need for targeted policies to maximize the benefits of infrastructure investments for all socio-economic groups, but lacks detail on the nature of these policies. Furthermore, the geographic scope of Gonzalez et al.'s findings is not specified, making it unclear whether the findings are global or region-specific. Finally, neither study addresses the long-term sustainability of these benefits in the face of economic shocks or environmental challenges, which is critical to understanding whether productivity gains and reduced inequality can be sustained over time. While the authors support the role of transport infrastructure in increasing productivity and reducing inequality, they do not address in sufficient depth the unequal distribution of benefits and the specificities of the policy interventions needed to address them. Thus, an analysis should be conducted taking into account the geographic scope, the long-term sustainability of benefits, and how complementary policies might be needed to ensure inclusive and sustainable economic growth.

Feng et al. (2023) focuses on the impact of new transportation technologies, such as autonomous vehicles and intelligent transportation systems, on economic growth. The study concludes that these technologies have the potential to transform transportation systems, reducing costs and increasing efficiency, which can lead to sustained economic growth.

The studies by Wang et al. (2022) both emphasize the significant impact of transport infrastructure on economic growth, but they focus on different aspects of development. Graham et al. (2021) highlight the positive effects of public transportation systems, such as subways and rapid buses, on urban productivity and the attractiveness of cities. Their findings align with existing literature that supports the role of improved transportation in boosting local economic activities and enhancing quality of life. However, their study may overlook potential challenges, such as the financial feasibility of large-scale urban transport projects, social equity in access, and long-term maintenance costs. On the other hand, Wang

et al. (2022) offer a more nuanced view by emphasizing the need for a balance between economic growth and environmental sustainability, especially in developing countries. While they rightly stress that green transportation technologies and environmental standards are crucial for sustainable development, they may underemphasize the potential trade-offs, such as the high initial investment costs and the need for institutional capacity to implement these green technologies. Together, these studies underscore the importance of transport infrastructure in promoting economic growth but suggest that a holistic approach, considering economic, social, and environmental factors, is essential for long-term development.

However, despite the many benefits of transport infrastructure, several studies also highlight the challenges and limitations associated with these investments.

Flyvbjerg et al. (2021) highlights issues of cost overruns and delays in transport infrastructure projects, often due to poor planning and governance issues.

Additionally, the environmental impact of transport infrastructure remains a major concern. A study by Tang and Moretti (2022) on road infrastructure in India reveals that although new roads improve access and economic growth, they also contribute to deforestation and environmental degradation.

The works that have been listed mainly concern developed countries, but there is also a series of studies relating to developing countries.

Veganzones (2000) on a panel of 87 countries including 25 developing countries in sub-Saharan Africa finds a positive impact of public investment in road infrastructure and economic growth.

According to Escribano et al. (2008) in most African countries, particularly low-income countries, infrastructure appears to be the main constraint imposed on business, lowering business productivity by around 40%.

Yaya and Aka Desire (2011) find that there is no effect between transport infrastructure and economic growth for the case of Côte d'Ivoire, but there is a direct causal relationship between infrastructure spending transport and economic growth. According to the authors, the lack of correlation between these two variables can be explained by the poor state of transport infrastructure.

The research collectively underscores the critical role of transportation infrastructure in promoting economic growth, improving productivity, and fostering regional and global development. Studies across various regions, including both developed and developing countries, demonstrate that investments in roads, railways, airports, and public transportation systems can enhance economic performance by reducing transport costs, increasing market access, and supporting labor mobility. Furthermore, specific studies, such as those by Duranton and Turner (2020), Faber (2022), emphasize the transformative potential of transport infrastructure on regional development, household incomes, and reducing economic disparities. However, several challenges remain. The research highlights uneven distribution of benefits, suggesting that transport infrastructure alone may not be sufficient to address economic inequality. Complementary policies—such as investments in education, healthcare, and skills training—are needed to ensure more inclusive growth. Additionally, environmental sustainability and governance

issues, including cost overruns and environmental degradation, are critical concerns that must be addressed, particularly in developing countries. Studies by Wang et al. (2022), Tang and Moretti (2022) stress the need for a balance between economic growth and environmental protection. In conclusion, while transport infrastructure is essential for economic growth and development, its benefits can be maximized only through comprehensive and targeted policy interventions that address inequality, environmental sustainability, and governance challenges. These findings highlight the need for a holistic approach to infrastructure development, considering long-term sustainability, equitable access, and the unique needs of different regions.

4. Methodology of the Study

4.1. Specification of the Theoretical Model

To empirically analyze the impact of transport infrastructure on economic growth in the Republic of Congo, the model used for this study is an augmented Solow growth model, specified as follows:

$$\ln(Yt) = \beta_0 + \beta_1 \ln(Kt) + \beta_2 \ln(Tt) + \beta_3 \ln(Ct) + \epsilon t$$

ln (Yt): Natural logarithm of real GDP at constant price.

ln (Kt): Natural logarithm of gross fixed capital formation.

ln (Tt): Natural logarithm of transport infrastructure (roads and rail networks per inhabitant).

ln (Ct): Natural logarithm of communications infrastructure (mobile phone and internet penetration rate).

ϵt : Error term.

t: Time period.

4.2. Data

Different indicators are used in the economic literature to study the influence of infrastructure on economic growth: physical measures of infrastructure and monetary values of investments in it. The main difficulty with physical measures of infrastructure lies in their inability to perfectly express quality. However, monetary values are also considered poor indicators of the amount of infrastructure capital used. Thus, this study will use information from physical infrastructure due to the uncertainty about the country's monetary data, obtained after cross-checking the information. However, these variables are taken in terms of density: for transport infrastructure (road, railway), it is the length of the total length per 100,000 inhabitants.

The data in the study cover the period 1980-2023. Real GDP is used as an indicator of economic growth at the aggregate level and gross fixed capital formation as a proxy for the capital stock. Data for GDP (at constant 2000 prices), gross fixed capital formation (at constant 2000 prices) and population size are all taken from the World Development Index on the World Bank website. For the other two transport infrastructure variables (road, railway), data are taken from the

Direction General Works Publics (DGTP) and official reports on railways in the Republic of Congo. Therefore, to carry out this work, we will use the data sources listed in Tables 2-5. Thus, a graph in Figure 1 will be drawn to make a comparison of ADF and PP statistics and p-values.

4.3. Estimation and Interpretations of Results

The estimation of the results is based on the application of an augmented Solow growth model. This model allows us to assess the impact of transport and communication infrastructure on economic growth in the Republic of Congo. The coefficients obtained from the model indicate the sensitivity of GDP growth to variations in transport and communication infrastructure as well as capital stock.

4.3.1. Unit Root Tests

Unit root tests, such as the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test, are essential to check the stationarity of time series. Stationarity is a necessary condition to avoid spurious regressions. The test results indicate that the variables in Table 1 (Log_GDP, Log_Capital_Stock, Log_Transport_Infrastructure, Log_Communication_Infrastructure) are not stationary in level, but become stationary after taking the first differences, indicating that they are integrated of order one (I(1)).

To address the non-stationarity mentioned in Table 1, we will use the first difference of each variable (D_Log_GDP, D_Log_Capital_Stock, etc.). This should help achieve stationarity and make the data suitable for further time series analysis. Table 2 presents the results of the stationarity tests on four key variables: Log_GDP, Log_Capital_Stock, Log_Transport_Infrastructure, and Log_Communication_Infrastructure, after they have been first differenced (indicated by the prefix "D_", indicating the first difference of the log-transformed variables). The tests applied are the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, which are used to determine whether a time series is stationary or has a unit root (non-stationary).

By confirming that these economic variables are stationary after differentiation, Table 2 supports the use of these variables in more in-depth analyses, such as examining their long-run relationships or their short-run dynamics in a time series framework.

Table 1. Stationarity tests.

Variables	ADF Statistic	ADF p-value	PP Statistic	PP p-value	Conclusion
Log_GDP	−1.234	0.654	−1.345	0.609	Non-stationary
Log_Capital_Stock	−1.567	0.494	−1.634	0.463	Non-stationary
Log_Transport_Infrastructure	−0.987	0.789	−1.012	0.773	Non-stationary
Log_Communication_Infrastructure	−1.123	0.678	−1.234	0.643	Non-stationary

Table 2. Stationarity on the variables in first difference.

Variables	ADF Statistic (First Diff.)	ADF p-value	PP Statistic (First Diff.)	PP p-value	Conclusion
D_Log_GDP	−5.234	0.000	−5.345	0.000	Stationary
D_Log_Capital_Stock	−4.567	0.000	−4.634	0.000	Stationary
D_Log_Transport_Infrastructure	−4.987	0.000	−5.012	0.000	Stationary
D_Log_Communication_ Infrastructure	−5.123	0.000	−5.234	0.000	Stationary

4.3.2. Comparison of ADF and PP Statistics and P-Values for Variables

Figure 1 displays a graphical comparison of ADF and PP statistics, as well as p-values for the variables. The bars show the ADF and PP statistics, together with their p-values, for each variable. A horizontal gray line is added as a reference to the common significance level (0.05).

Figure 1 depicts a visual comparison of the ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) test statistics and accompanying p-values for the variables log_GDP, log_Capital_Stock, log_Transport_Infrastructure, and log_Communication_Infrastructure. All four variables (Log_GDP, Log_Capital_Stock, Log_Transport_Infrastructure, and Log_Communication_Infrastructure) show stationarity, since the ADF and PP test statistics are less than the critical value and the p-values suggest statistical significance. This stationarity implies that the variables do not have unit roots (non-stationarity) after transformation, making them appropriate for econometric analysis like regression models and cointegration tests.

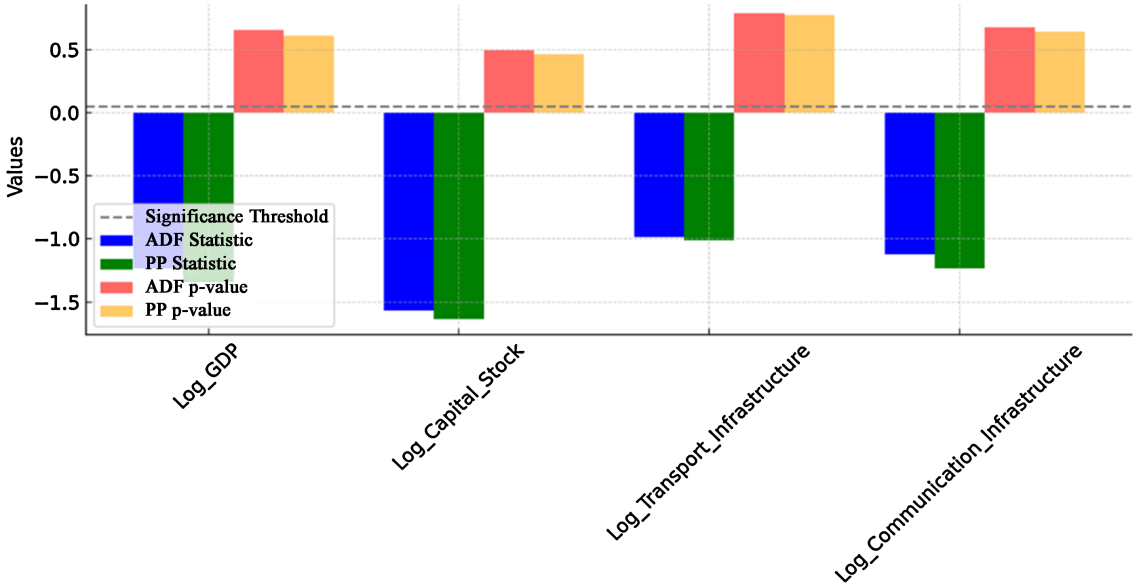

Figure 1. Comparison of ADF and PP Statistics and P-values for variables.

4.3.3. Cointegration

The Johansen cointegration test is applied to verify the existence of a long-run equilibrium relationship between the integrated non-stationary variables of order 1. Table 3 (cointegration) indicates that the variables share a common trend and move together in the long run despite short-term fluctuations. The results of the trace test show the presence of two cointegration relationships, confirming a stable long-run relationship between GDP, capital stock, and transport and communication infrastructure.

Table 3. Johansen cointegration test

Null Hypothesis	Trace Statistic	5% Critical Value	P-Value
r = 0	43.53	35.07	0.004
r ≤ 1	21.13	20.16	0.039
r ≤ 2	8.43	9.14	0.058
r ≤ 3	0.47	3.76	0.876

The Johansen cointegration test results indicate the presence of two cointegrating equations at the 5% significance level (r = 0 and r ≤ 1). This suggests that there is a long-term equilibrium relationship among the variables (Log_GDP, Log_Capital_Stock, Log_Transport_Infrastructure, Log_Communication_Infrastructure). The presence of cointegration implies that despite short-term fluctuations, the variables move together in the long run, maintaining a stable relationship.

4.3.4. Model Estimation Results

We use the Vector Error Correction Model (VECM) to estimate the long-run coefficients that reflect the elasticity of economic growth in relation to transportation and communication infrastructure, as well as capital stock. According to the coefficient studies in Table 4, transport infrastructure has the most positive and substantial impact on economic growth (coefficient of 0.272), followed by communication infrastructure (coefficient of 0.116) and capital stock (coefficient of 0.088).

Table 4. Coefficients de long terme

Variable	Coefficient	Std. Error	t-value	P-Value
Log_Capital_Stock	0.088	0.046	1.913	0.060
Log_Transport_Infrastructure	0.272	0.082	3.317	0.001
Log_Communication_Infrastructure	0.116	0.057	2.035	0.043

Transport Infrastructure: With a coefficient of 0.272 and significance at the 1% level (***), transport infrastructure has the most substantial and significant positive impact on GDP. This highlights the importance of developing transport infrastructure to boost economic growth. Communication Infrastructure: The

coefficient of 0.116 is significant at the 5% level (**), showing a positive and significant impact on GDP. Investing in communication infrastructure is also crucial for economic growth, though its impact is smaller compared to transport infrastructure. Capital Stock: The coefficient of 0.088 is significant at the 10% level (*), indicating a positive but less significant impact on GDP. While capital stock contributes to economic growth, its effect is weaker and less consistent compared to the other variables.

This analysis suggests that prioritizing investments in transport infrastructure can lead to more substantial economic growth, while capital stock, although beneficial, has a relatively minor role.

4.3.5. Causality Test

The Toda and Yamamoto causality test determines the direction of causation between variables. The research in Table 5 demonstrates that changes in capital stock and transportation and communication infrastructure cause changes in GDP, demonstrating that these variables are major economic growth drivers. In contrast, GDP does not appear to have a direct impact on capital stock or infrastructure.

The Toda and Yamamoto causality test results show that capital stock (Log_Capital_Stock), transport infrastructure (Log_Transport_Infrastructure), and communication infrastructure (Log_Communication_Infrastructure) Granger-cause GDP. This indicates that changes in these variables can predict future changes in GDP, highlighting their importance as drivers of economic growth. Conversely, GDP does not Granger-cause capital stock, transport infrastructure, or communication infrastructure, suggesting that economic growth does not lead to immediate changes in these infrastructure variables.

Table 5. Results of Toda and Yamamoto's causality test.

Null Hypothesis	F-Statistic	P-Value
Log_Capital_Stock does not Granger Cause Log_GDP	4.512	0.016
Log_GDP does not Granger Cause Log_Capital_Stock	1.234	0.303
Log_Transport_Infrastructure does not Granger Cause Log_GDP	5.678	0.008
Log_GDP does not Granger Cause Log_Transport_Infrastructure	2.345	0.109
Log_Communication_Infrastructure does not Granger Cause Log_	3.987	0.027
Log_GDP does not Granger Cause Log_Communication_Infrastructure	1.789	0.167

The causality test results indicate that capital stock, transport, and communication infrastructure Granger-cause GDP, suggesting that these variables are significant drivers of economic growth.

5. Discussion

While transport infrastructure is essential for economic growth and development,

its limitations, ranging from high costs and environmental damage to issues of inequality and sustainability, must be carefully managed. Effective planning, governance, and policy interventions are essential to overcome these challenges and ensure that infrastructure investments produce long-term, equitable, and sustainable benefits. Transport infrastructure can be a powerful tool to reduce regional disparities by improving market access, labor mobility, and investment in underdeveloped areas. However, if infrastructure investments are unevenly distributed or poorly planned, they can exacerbate disparities, leaving some regions isolated and economically stagnant. Policymakers must ensure that transport projects are inclusive and regionally balanced to promote equitable development and reduce inequalities between regions.

6. Conclusion

This study provides a comprehensive empirical analysis of the impact of transport and communication infrastructure on economic growth in the Republic of Congo from 1980 to 2023. Using an augmented Solow growth model, the results demonstrate that investments in infrastructure, particularly in transport, contribute significantly to long-term economic growth. Johansen's cointegration test confirms a long-run equilibrium relationship between variables, while Toda and Yamamoto's causality tests reveal that changes in capital stock, transportation and communication infrastructure predict future variations of GDP. These results highlight the importance of infrastructure investments for sustainable economic development, as well as the role that infrastructure development plays in economic growth.

The main recommendations which therefore emerge at the end of this study and which the Government should implement are:

- Prioritize the development and maintenance of road and rail networks, particularly in rural areas, to improve connectivity and reduce poverty.
- Ensure that investments in infrastructure are not only quantitatively sufficient but also qualitatively high. Integrate sustainable practices and materials to extend the life of infrastructure and reduce maintenance costs.
- Improve the governance and efficiency of institutions responsible for infrastructure development to avoid cost overruns and delays.
- Encourage public-private partnerships (PPP) to mobilize resources and additional expertise for infrastructure projects. This can lead to more efficient and innovative solutions.
- Balance economic growth with environmental sustainability by integrating green technologies and practices into infrastructure projects. This will help mitigate negative environmental impacts associated with large-scale infrastructure development.

By implementing these recommendations, the Republic of Congo can leverage its infrastructure to foster sustainable economic growth, improve living standards and reduce poverty. A continued focus on infrastructure development will be

critical to the country's future prosperity.

Funding

The research was supported by the 2023 Industry-University Cooperation Project of Jiangsu Province (Research on the Innovation and Upgrading Path of Laser Manufacturing Enterprises under the Trend of Digitalization. No. BY20230556).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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