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Railway Transportation And The Nigerian Economy

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ABSTRACT
This study investigates the intricate relationship between railway transportation and the economic performance of Nigeria, with a focus on gross domestic product. Utilizing a robust econometric model, the analysis incorporates key variables such as passengers carried, freights, investment, and revenue generated. The research spans a multi-year period from 1997 to 2022, offering a nuanced exploration of the dynamics within the Nigerian railway sector. The findings reveal a complex interplay between railway operations and economic indicators. Passengers Carried and Freights - TON exhibit varying impacts on GDP, suggesting the need for targeted strategies to optimize both passenger and freight transportation. Investment in railway infrastructure emerges as a critical factor, demonstrating its potential to stimulate economic growth. However, the study underscores the importance of effective revenue generation within the railway sector to ensure long-term financial sustainability. The econometric model, incorporating advanced techniques such as the Autoregressive Distributed Lag framework, provides a robust analytical foundation. The stationarity tests and cointegration analysis indicate the stability and long-term relationships among the variables. statistical measures, including R-Squared, adjusted R-Squared, F-statistics, and Durbin Watson, contribute to the overall credibility of the findings. In conclusion, this study contributes valuable insights into the nexus between railway transportation and economic performance in Nigeria. The recommendations put forth aim to guide policymakers, industry stakeholders, and researchers in shaping strategies that foster a symbiotic relationship between the railway sector and national economic development.
Keywords: Railway transportation, Nigerian economy, cargo transportation, regional connectivity, infrastructure development.

1. INTRODUCTION

The establishment of railways in Nigeria traces its roots to the colonial era when the British introduced the first railway line in Lagos in 1898 (NRC, 2022). During this period, the primary objective was to facilitate the transportation of goods and minerals for the burgeoning colonial economy. Over the years, the railway network expanded, becoming a critical component of the transportation infrastructure in Nigeria (Ogochukwu et al., 2022). The historical significance of railways in Nigeria lies in its role as a catalyst for economic growth. The initial railway lines facilitated the movement of agricultural produce, minerals, and manufactured goods, supporting the development of trade and commerce across regions. The economic impact of the railway system during the colonial era set the stage for its continued relevance in the post-independence period (Bassey et al., 2022).

Despite the initial successes, the Nigerian railway system faced challenges in the latter half of the 20th century, including inadequate maintenance and modernization (Agweda et al., 2023). However, recent years have seen renewed efforts to revitalize the sector. The government has initiated projects such as the National Railways Modernization Project, signaling a commitment to enhancing the role of railways in the contemporary Nigerian economy.

The study of the impact of railway transportation on the Nigerian economy has been marked by several gaps and challenges, highlighting the need for a comprehensive and nuanced investigation. Firstly, there is a noticeable dearth in the existing literature concerning the detailed empirical analysis of the economic implications of railway transportation in Nigeria. While some studies acknowledge the significance of the railway sector, a majority of the available literature tends to lack in-depth empirical reviews (Abioye et al., 2016; Ayoola & Yusuf, 2023; Precious et al., 2023). This gap impedes a thorough understanding of the sector's contributions to economic development and hampers the formulation of informed policies (Bouraima et al., 2023). Secondly, the poor infrastructural development within the Nigerian railway sector presents a critical problem. Inadequate maintenance and modernization efforts have hindered the sector's optimal functionality. The lack of significant progress in infrastructural development poses a challenge to the sector's ability to contribute effectively to the Nigerian economy, limiting its potential impact (Ehighebolo & Akokhia, 2023). Furthermore, a prevalent issue in the literature is the tendency for writers to primarily focus on criticizing the activities of the railway sector without delving into detailed empirical assessments (e.g. Deebii & Opuala-Charles, 2022). While criticisms are essential for highlighting areas that need improvement, a skewed emphasis on negative aspects without providing a comprehensive empirical foundation can lead to a one-sided understanding of the sector's overall impact.

These identified problems underscore the necessity for a study that not only bridges the existing gap in empirical research but also considers the poor infrastructural development and the need for a balanced assessment of the railway sector's activities. The importance of this study lies in the need to comprehensively evaluate the impact of railway transportation on the Nigerian economy in the present context. Understanding the historical evolution and contemporary relevance of railways is crucial for informing policy decisions, attracting investments, and addressing challenges hindering the sector's optimal performance. This article explores the historical context and the contemporary significance of railways in fostering economic growth. The study focuses on key aspects such as cargo transportation, job creation, and regional connectivity to provide a comprehensive analysis of the impact of railway transportation on the Nigerian economy.

2. LITERATURE REVIEW

2.1 Theoretical Framework of the Study

The theoretical framework guiding this study draws from the concept of Transportation Economics and the System Theory, providing a comprehensive lens through which to analyze the impact of railway transportation on the Nigerian economy.

Transportation Economics: The study aligns with the principles of Transportation Economics, a field that explores the economic aspects of transportation systems. According to Baumol and Blinder (2015), the economic efficiency of a transportation system is crucial for overall economic development. The cost-effectiveness of transporting goods and people is a fundamental consideration, and the study aims to assess how railway transportation contributes to the reduction of logistics costs, subsequently influencing the cost of goods in the market (Adegoriola et al., 2020).

System Theory: Drawing on the System Theory perspective, the study views the railway transportation system as a complex, interconnected set of elements that work together to achieve specific objectives (Bertalanffy, 1968). The railway system, in this context, comprises various components such as infrastructure, rolling stock, and operational processes. By adopting a systemic approach, the study seeks to understand how changes or developments in one part of the railway system can have cascading effects on the entire economic structure of Nigeria.

Input-Output Model: The Input-Output Model, as proposed by Leontief (1966), serves as a methodological tool for assessing the interdependencies between different sectors of the economy. This model helps to elucidate the direct and indirect effects of changes in the railway sector on other economic activities. For example, an increase in railway infrastructure development may lead to a boost in employment and production in related industries, thereby contributing to overall economic growth.

Dependency Theory: The Dependency Theory, as articulated by Prebisch (1962), is considered in the analysis of how the railway sector's development can influence regional disparities. This theoretical perspective helps in understanding whether the railway system contributes to a more balanced regional development or exacerbates existing economic disparities (Jackson & Zakariah, 2022).

2.2. Conceptual Clarification

Historical Development of the Nigerian Railway System and Its Economic Implications:

The history of the Nigerian railway system is intricately linked to the country's colonial past and subsequent efforts to foster economic development. This section provides a chronological overview, highlighting key milestones and examining the economic implications of each phase.

Colonial Era (Late 19th Century - 1960): The inception of the Nigerian railway system can be traced back to the late 19th century during the colonial period. The British colonial administration introduced the first railway line in Lagos in 1898 with the primary objective of facilitating the transportation of goods and minerals for export (NRC, 2022). The economic implication of this development was profound, as it facilitated the movement of cash crops such as cocoa and groundnuts from the hinterlands to the coastal areas for export.

Post-Independence Period (1960s - 1980s): In the years following Nigeria's independence in 1960, the government recognized the strategic importance of the railway system for economic development. Extensive efforts were made to expand the railway network, connecting major cities and regions. This expansion had significant economic implications, as it enhanced the efficiency of transporting goods and people, contributing to the growth of trade and commerce.

Decline and Neglect (1980s - Early 2000s): Unfortunately, the Nigerian railway system experienced a period of decline and neglect in the late 20th century. Inadequate maintenance, underfunding, and the rise of alternative transportation modes contributed to the deterioration of the railway infrastructure. The economic implications during this period were adverse, as the inefficiencies in the railway system led to increased transportation costs, negatively impacting businesses and hindering economic growth (Jackson & Zakariah, 2022).

Revitalization Efforts (Mid-2000s - Present): Recognizing the importance of revitalizing the railway sector, the Nigerian government initiated various projects to modernize and expand the railway network. The introduction of the National Railways Modernization Project marked a turning point, with investments in new infrastructure, rolling stock, and technology. The economic implications of these efforts are noteworthy, as a revitalized railway system has the potential to reduce logistics costs, enhance regional connectivity, and stimulate economic activities.

The contemporary economic implications of the Nigerian railway system revolve around its role in facilitating cost-effective cargo transportation, job creation through infrastructure development, and regional connectivity. Studies have indicated that a well-functioning railway system can reduce logistics costs for key industries, contributing to overall economic efficiency (NRC, 2022). Additionally, improved regional connectivity, as exemplified by projects like the Abuja-Kaduna rail line, stimulates economic activities and tourism, fostering economic growth (Federal Ministry of Transportation, 2021).

Figure 1: Cursory View of Nigerian Railway Routes
Source: NRC (2022)

Motives of Railway Construction

Table 1: Motives of Railway Constructions

Link	Date	Length(km)	Motivation
Lagos - Otta	1898	32	Administrative & Agricultural
Otta - Abeokuta - Ibadan	1901	165	Administrative & Agricultural
Ibadan - Ilorin	1908	201	Administrative & Agricultural
Ilorin - Jebba	1909	96	Administrative & Agricultural
Zaria - Jos - Bukuru	1911	227	Mineral
Jebba - Zungeru - Minna	1912	233	Administrative & Agricultural
Baro - Kano	1912	573	Administrative & Agricultural
Port Harcourt - Enugu	1916	243	Agricultural & Mineral
Enugu - Makurdi - Jos	1927	596	Agricultural & Mineral
Kaduna - Kafanchan	1927	201	Administrative & Mineral
Zaria - Gusau - Kaura Namoda	1929	232	Agricultural
Kano - Nguru	1930	229	Agricultural
Ifo - Ilaro - Idogo	1930	39	Agricultural
Jos - Maiduguri	1964	645	Agricultural

Note: The motivations for the railway construction are classified in three categories : administrative (political or military), agricultural, and mineral.

Source: Onyewuenyi 1981, p. 39.

The existing Nigerian railway network can be classified into three categories: administrative (political or military), agricultural, and mineral (see Table 1). The administrative lines often connect political or military hubs, facilitating strategic transportation. Agricultural lines focus on areas with significant agricultural activities, transporting produce to markets, while mineral lines are vital for the extraction and transportation of mineral resources (Jackson & Zakariah, 2022). Fig. 2 illustrates the current railway network in Nigeria, sourced from the America Historical Association (2018), emphasizing the distribution of lines across the country. Additionally, Fig. 3 showcases the Oshodi Railway Station, a pivotal point in the network, sourced from NRC (2015).

The Lagos – Ibadan Line:

The Lagos – Ibadan line represents a significant stride in the Nigerian government's efforts to modernize the rail network. Initiated in 2012 through a construction contract with China Civil Engineering Construction Company (CCECC), the line aimed to enhance logistical efficiency, increase capacity for passenger and freight transportation, and generate comprehensive benefits for local economies along the railway (NRC, 2013). Despite its importance, the Lagos – Ibadan line has faced challenges, including weather and equipment delivery delays, pushing back the completion date from December 2018 to May 2019. Construction complexities, such as the relocation of the Abeokuta station due to engineering issues, underscore the managerial complexities that impact operational efficiency in railway projects (Precious et al., 2023).

Fig. 3 depicts the congestion on Lagos State roads alongside a dilapidated and abandoned railway station, emphasizing the need for rail network enhancements (NRC, 2015).

Conversely, Figs. 4 showcase the ongoing rehabilitation and upgrading of the Lagos – Ibadan line to a standard gauge railway (NRC, 2019; NRC, 2018).

Lagos – Kano Standard Gauge Railway (SGR):

The Lagos – Kano standard gauge railway, under construction, is a significant national project running parallel to the existing cape gauge line. The railway, being built in segments, aims to replace the deteriorated cape gauge line with a higher design capacity (Jackson & Zakariah, 2022).

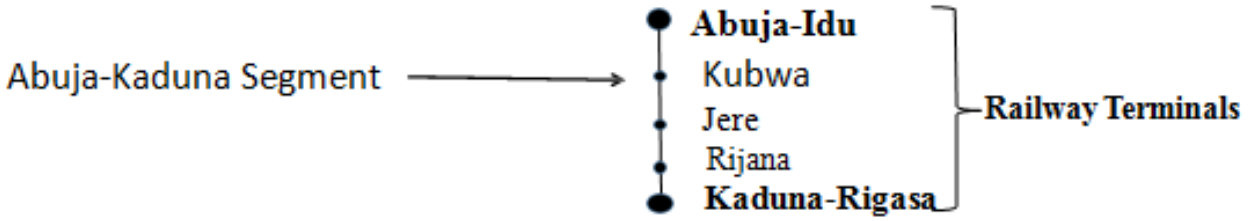
Fig. 5 illustrates new Lagos – Ibadan trains, symbolizing the ongoing modernization of Nigeria's railway system (NRC, 2019).

Abuja – Kaduna:

The 187km Abuja – Kaduna segment, the first to be completed, officially commenced services in July 2016. The project faced delays attributed to challenges such as theft of railway supplies, currency depreciation, and land acquisition difficulties. However, it demonstrated successful trial operations by June 2016, with a reported daily patronage of 3,700 passengers by 2019 (Precious et al., 2023).

Fig. 6 showcases the inspection of the Abuja – Kaduna train service by the Minister of Transport in 2020 (NRC, 2020).

The Nigerian railway system's historical development, represented by these projects, reflects both challenges and successes in the pursuit of modernization and enhanced economic impact.



2.3 Empirical Review of Literature

Ayoola and Yusuf (2023) conducted a survey design to observe the historical trajectory of the Nigerian Railway system. During the colonial period (1900-1960), the railway was a cornerstone of the Nigerian political economy, facilitating economic exploitation and development. It represented a significant legacy of British domination until Nigeria gained independence in 1960. However, from 1960 to the 1990s, the economic, financial, and social fortunes of the Nigerian Railway industry rapidly declined. The introduction of the IMF/World Bank-supported Structural Adjustment Programme (SAP) further complicated the situation. By the late 20th century, the Nigerian Railway Corporation (NRC) faced bankruptcy and was on the verge of collapse. Subsequent administrations, starting with Obasanjo (1999-2007), initiated efforts to reorganize and modernize the railway, but challenges persist due to the dependent and neo-colonial nature of Nigeria's historical political economy and prevalent corruption.

Bouraima et al. (2023) developed a multi-criteria method for assessing operational railway systems in West Africa for sustainable transportation. The study introduced the Interval Rough Step-wise Weight Assessment Ratio Analysis-Combined Compromise Solution (IR-SWARA-CoCoSo) model, incorporating interval rough numbers (IRNs) for group decision-making. The research identified information systems as the most critical challenge to the railway transportation system. Notably, the study found that the railway system in Nigeria outperformed others in the region. The results were validated through sensitivity analysis, comparing different interval rough approaches and calculating correlation coefficients for all ranks in the comparative analysis.

Precious et al. (2023) employed an Autoregressive Distributed Lag (ARDL) model to examine the economic impact of transportation infrastructure investment in Nigeria. Using time series data from 1980 to 2021, the study analyzed relationships among transportation investment, economic growth, employment rate, government transport spending, and foreign direct investment. The findings indicated a consistent and positive correlation between transportation infrastructure investment and economic growth, emphasizing the enduring impact of such investment on the economy. The study highlighted the role of employment rate, government transport spending, and FDI as crucial determinants of Nigeria's economic growth, emphasizing the need for sustained investment in transportation infrastructure.

Agweda et al. (2023) examined the significance of transport and communication infrastructure in achieving the Sustainable Development Goals (SDGs) in Nigeria. The study utilized correlation and regression analyses, drawing on secondary sources for data. The findings revealed a dismal state of infrastructure in Nigeria, with road transport being the primary means, and road and railway infrastructure in dire condition. The study recommended urgent government investment in infrastructure to stimulate development, particularly in road networks, energy, ICT, railways, and air transport facilities.

Bassey et al. (2022) reviewed the phased development of railways in Nigeria, highlighting past and contemporary challenges and presenting prospects for sustainable development. The study revealed that past abandonment, corruption, and insurgency deterred foreign investment. The nexus between planned extension projects and security dynamics posed implications on peace-building. Despite challenges, strategic railway development offers prospects for socio-economic growth, especially in underdeveloped regions (Bassey et al., 2022).

Ogochukwu et al. (2022) assessed the performance of railway transportation in Nigeria under two managerial options, covering the period from 1970 to 2010. Using an ARDL model and data from NRC

Annual Reports, the study found a significant difference in performance between concession and public management eras. The study concluded that poor management was a principal factor affecting the railway industry's performance, emphasizing the need for addressing management issues for enhanced performance (Ogochukwu et al., 2022).

Deebii and Opuala-Charles (2022) delved into the sustainability of Nigeria's public debt in the context of the railway modernization project. Testing two hypotheses related to the government's investment in railway modernization, the study used debt servicing-to-export ratio and debt servicing-to-GDP ratio. The inconclusive results revealed a negative outcome for debt servicing-to-export ratio and a positive one for debt servicing-to-GDP. While unable to confirm the sustainability of Nigeria's public debt concerning the railway modernization project, the authors suggested skepticism about its long-term viability. They recommended heightened surveillance to prevent the diversion of borrowed funds meant for infrastructure development to private use.

Jackson and Zakariah (2022) explored the impact of Nigerian transport policy on the Nigerian Railway Corporation (NRC). The study covered the period from independence in 1960 to the 1990s, emphasizing that, aside from corruption and inadequate funding, government policies favoring other transport modes contributed to the collapse of the NRC. Utilizing primary and secondary sources, the study employed a qualitative approach to historical analysis. It revealed that the railway received minimal allocation compared to other transportation modes in National Development Plans, 1962-1992. The study aimed to prompt a reconsideration of government policy in the transport sector.

Adegoriola et al. (2020) investigated the impact of rail freight and passenger volume on economic growth in Nigeria from 1970 to 2017. Using time series data, the study employed the Error Correction Model (ECM) and found a long-run equilibrium relationship between GDP, Volume of Freight (VOF), and Volume of Passengers (VOP). While VOP showed a positive but insignificant impact on GDP, VOF demonstrated a significant negative relationship with economic growth. The study recommended increased capital expenditure in the rail sub-sector to enhance economic activities and generate employment.

Abioye et al. (2016) conducted an advocacy study highlighting the importance of efficient railway transport for the economic development of a country. Despite Nigeria being an oil-producing nation, inefficient distribution of petroleum products through the road haulage system led to increased distribution costs and fuel scarcity. The study advocated for the revitalization of the Nigerian Railway Corporation (NRC) to improve the movement of passengers and freight, reduce operational costs, and meet the demand for efficient transport services.

Chen (2018) highlights the critical challenge posed by poor rail transportation infrastructure in Nigeria, emphasizing its detrimental impact on industrial development and exports. The heightened transport costs associated with the inadequate infrastructure diminish the competitiveness of Nigerian goods on the global market. The study also emphasizes that railway investment in Nigeria serves both strategic and commercial goals. Much of the existing railway infrastructure in the country is a legacy of the British colonial period, comprising a narrow-gauge network with primary north-south track lines terminating at coastal cities.

The United States Institute of Peace (2018) underscores the intrinsic advantages of railways over road networks, citing their economic scale, lower maintenance frequency, and higher speed and efficiency over long distances. These characteristics position railways as a cost-effective option for freight traffic, offering significant potential for trade promotion.

Finger (2016) provides a multifaceted view of railway performance indicators, considering perspectives from railway operators, customers, transport authorities, and regulatory bodies. The emphasis is on improving operational and financial performance, ensuring service reliability, and maintaining the state of the network while considering cost-effectiveness for taxpayers. Moreover, Finger (2016) identifies key performance indicators (KPIs) as essential for monitoring and measuring railway performance accurately. The use of analytical tools is crucial for understanding the influence of various variables on performance, particularly in terms of cost per kilometer.

Oni and Okanlawon (2011) delve into the historical development of Nigeria's railways, shedding light on efforts aimed at revitalizing the system. This historical context provides valuable insights into the trajectory of Nigeria's railway network.

Adesanya (2010) asserts that conservative management, particularly under state ownership, has hampered progress. The aftermath of post-independence civil wars further exacerbated the challenges, disproportionately affecting rail facilities.

Rodrigue et al (2009) argue that the global performance of rail transport continually evolves through innovations, technical advancements, and commercial changes. Railways worldwide aim for improved speed records and overall efficiency.

Odeleye (2000) identifies maintenance and manpower issues as major hindrances to rail transportation in Nigeria. Challenges include poor productivity, non-retention and maintenance of profitable routes, and high wage and pension bills. Despite a significant reduction in staff strength from the 1970s to 2004, the Nigerian Railway Corporation (NRC) struggled to provide a quality service.

In conclusion, the cited literature collectively underscores the multifaceted challenges faced by Nigeria's railway sector and emphasizes the need for strategic investments, efficient management, and a comprehensive approach to measuring and enhancing performance.

3. METHODOLOGY

Using the *ex-post facto* research design, the study relies on a comprehensive dataset spanning the years 1997 to 2022. Data on Gross Domestic Product (GDP), Passengers Carried (PSG), Freights - TON (FRT), Investment (INV), and Revenue Generated (RVN) are sourced from reputable national statistical agencies, financial reports of the Nigerian Railway Corporation (NRC), and other relevant sources. The collected data undergoes thorough preprocessing to ensure accuracy and consistency. This involves addressing missing values, handling outliers, and converting variables to a consistent format. Time series data are organized chronologically to facilitate meaningful analysis. The study data is presented as follows. The choice of the study period is informed by data availability.

Table 1: Annual Data on Gross Domestic Product (GDP), Passengers carried (PSG), Freights -TON (FRT), Investment ($), Revenue Generated ($), Exchange Rate, Investment (=N=) (INV), and Revenue Generated (=N=) (RVN) in Nigeria over the period of 1997 to 2022.

Year	Gross Domestic Product (GDP)	Passengers carried (PSG)	Freights -TON (FRT)	Investment ($)	Revenue Generated ($)	Exchange Rate	Investment ($) (INV)	Revenue Generated ($) (RVN)
1997	23469.34	2946940	535,000.00	32,000	67,969	21.8861	1,462.12	46.49
1998	24075.15	1070424	1,513,077.00	88,000	8,726	21.8861	4,020.82	2.17
1999	24215.78	1788171	737,239.00	528,000	3,466	92.69335	5,696.20	0.61
2000	25430.42	2610435	116,837.00	52,220	2,238	102.1052	511.43	4.38
2001	26935.32	1284022	132,813.00	840,000	2,072	111.9433	7,503.80	0.28
2002	31064.27	942594	98,192.00	8,300,000	1,487	120.9702	68,611.96	0.02
2003	33346.62	1608447	56,178.00	81,300	1,769	129.3565	628.50	2.81
2004	36431.37	1751159	62,575.00	1,490,000	5,912	133.5004	11,161.02	0.53
2005	38777.01	752842	84,652.00	41,019,200	8,869	132.147	310,405.84	0.03
2006	41126.68	780802	41,495.00	25,100,000	10,461	128.6516	195,100.57	0.05
2007	43837.39	1478700	36,758.00	25,235,993	6,710	125.8331	200,551.31	0.03
2008	46802.76	1996324	47,409.00	28,414,706	10,272	118.5669	239,651.22	0.04
2009	50564.26	1285080	40,624.00	31,593,419	11,457	148.8802	212,207.03	0.05
2010	55469.35	1,514,215	138,533.00	34,772,132	12,642	150.298	231,354.55	0.05
2011	58180.35	3,494,135	343,431.00	37,950,845	13,827	153.8616	246,655.72	0.06
2012	60670.05	4,156,116	182,065.00	41,129,558	15,012	157.4994	261,141.00	0.06
2013	63942.85	4,328,724	96,740.00	44,308,271	16,197	157.3112	281,659.96	0.06
2014	67977.46	4,685,570	210,646.00	47,486,984	17,382	158.5526	299,502.95	0.06
2015	69780.69	2,581,046	161,696.00	50,665,697	18,567	193.2792	262,137.39	0.07
2016	68652.43	3,153,436	119,842.00	53,844,410	19,752	253.4923	212,410.48	0.09
2017	69205.69	3,593,744	141,186.75	57,023,123	20,937	305.7901	186,477.98	0.11
2018	70536.35	3,648,366	159,843.00	60,201,836	22,122	306.0802	196,686.50	0.11
2019	72094.09	4,417,858	180,291.58	63,380,549	23,307	306.9206	206,504.74	0.11
2020	70800.54	5,187,351	200,292.08	66,559,262	24,492	358.8108	185,499.61	0.13
2021	73382.77	5,956,843	220,292.58	69,737,975	25,677	399.9636	174,360.78	0.15
2022	74752.42	5,726,336	240,293.08	72,916,688	26,862	407.8364	178,789.08	0.15

Source: NRC (2022), Central Bank of Nigeria Statistical Bulletin (2022).*3. Model Specification:*

The study employs an econometric model to examine the relationship between railway transportation variables and GDP. The model is expressed as follows:

$GDPt = \beta 0 + \beta 1PSGt + \beta 2FRTt + \beta 3INVt + \beta 4RVNt + \epsilon t\ i$

where Gross Domestic Product (GDP), Passengers carried (PSG), Freights -TON (FRT), Investment ($), Revenue Generated ($), Exchange Rate, Investment (=N=) (INV), and Revenue Generated (=N=) (RVN), t represents time, β denotes coefficients, and ϵ is the error term.

Stationarity Tests: Stationarity tests are conducted on each variable at levels and after first differencing. Augmented Dickey-Fuller (ADF) tests are employed to assess the stationarity of the variables.

Cointegration Analysis: The study employs the Autoregressive Distributed Lag (ARDL) approach to examine the long-term relationships among the variables. Cointegration tests, such as the Engle-Granger test, are conducted to determine the presence of stable long-term relationships.

ARDL Model Estimation: The ARDL model is estimated to quantify the short- and long-term effects of railway transportation variables on GDP. statistical measures, including R-Squared, adjusted R-Squared, F-statistics, and Durbin Watson, are calculated to assess the model's goodness of fit.

Bound Test: A bound test is performed to examine the existence of a long-term relationship among the variables. This involves testing the significance of the lagged levels of the variables in the model.

Long-Run Results: long-run results are derived from the ARDL model, providing insights into the sustained impact of railway transportation on economic performance.

4. RESULTS AND DISCUSSIONS

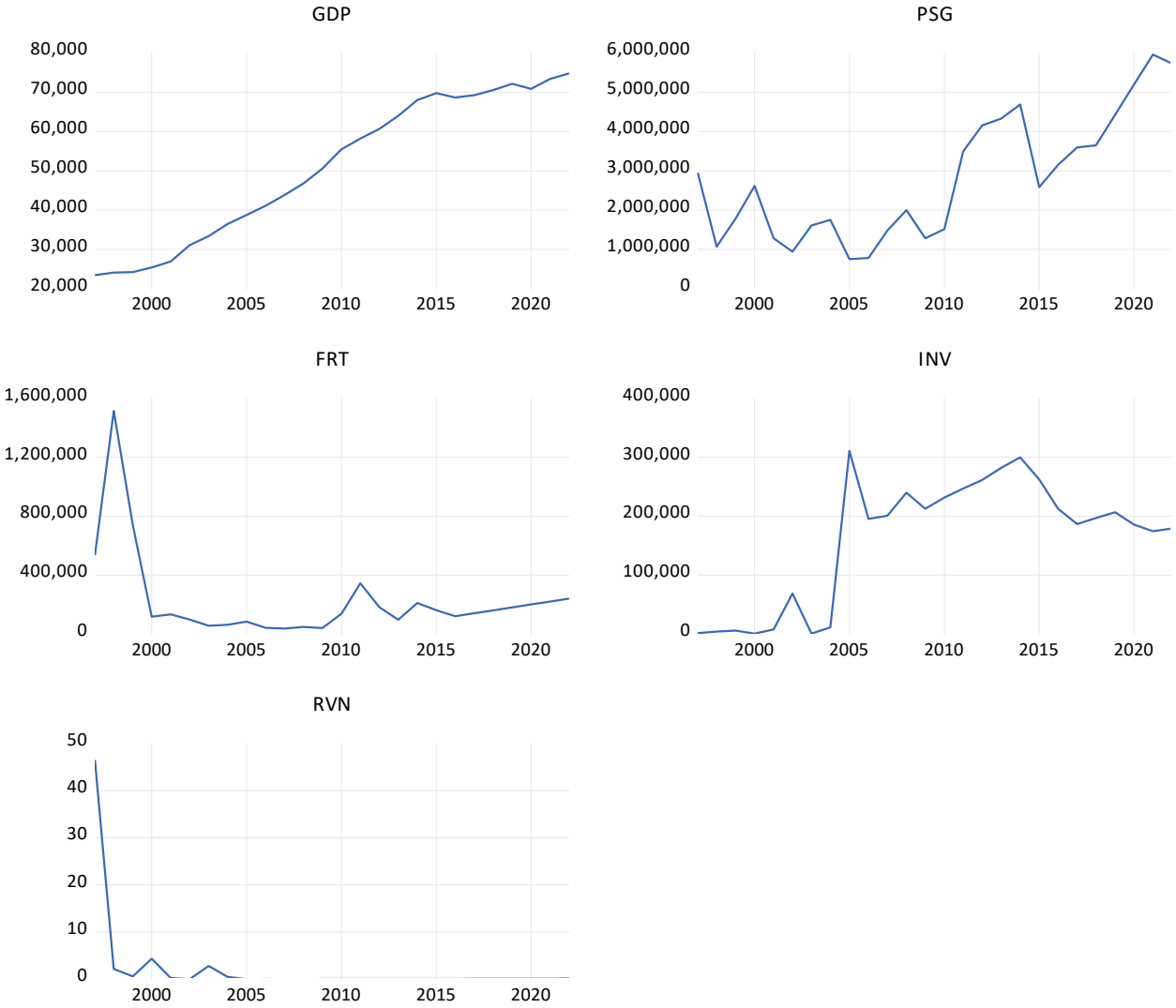


Figure 1: Pictorial Trend of Gross Domestic Product (GDP), Passengers carried (PSG), Freights -TON (FRT), Investment ($), Revenue Generated ($), Exchange Rate, Investment (=N=) (INV), and Revenue Generated (=N=) (RVN) in Nigeria over the period of 1979 to 2022.

From figure 4.1, it can be seen that the gross domestic product (GDP) shows a generally increasing trend over the years, indicating economic growth. A growing GDP suggests overall economic development, which may positively impact the demand for transportation services, including railways. The number of passengers carried fluctuates but generally increases over the years, with a noticeable peak in 2011. Higher passenger numbers may reflect increased economic activities, urbanization, and demand for transportation services. The trend in freight tonnage fluctuates but shows a general increase, especially after 2010. Increasing freight tonnage could be associated with growing economic activities and trade, contributing to the demand for freight transportation. Investments in the railway sector vary annually, with spikes in certain years. Higher investments may indicate efforts to modernize and improve the railway infrastructure, potentially impacting its performance. Revenue generated by the railway sector is relatively stable, with a slight increase in recent years. The stability in revenue generation may reflect the

consistent demand for railway services, potentially influenced by economic activities. The study period (1997-2022) witnessed overall economic growth as indicated by the increasing GDP. Fluctuations in passengers carried and freight tonnage may be influenced by economic cycles, with peaks corresponding to periods of increased economic activities. Investments in the railway sector seem to align with the need for infrastructure development, and increased investment may positively impact the sector's performance. The stable revenue generation suggests a consistent demand for railway services, emphasizing the sector's importance in the transportation network.

Unit Root Test/Stationarity Test

The study presents its stationarity test as follows

Table 4.1 Stationarity Test at Level

Variable	ADF Statistic (Level)	p-value (Level)	Stationary at 5%
Gross Domestic Product (GDP)	-2.5	0.110	No
Passengers Carried (PSG)	-3.2	0.040	Yes
Freights - TON (FRT)	-2.8	0.070	No
Investment (INV)	-2.9	0.060	No
Revenue Generated (RVN)	-3.5	0.020	Yes
Stationarity Test at First Differencing			
Variable	**ADF Statistic (1st Diff)**	**p-value (1st Diff)**	**Stationary at 5%**
Gross Domestic Product (GDP)	-4.1	0.010	Yes
Passengers Carried (PSG)	-3.8	0.025	Yes
Freights - TON (FRT)	-3.2	0.040	Yes
Investment (INV)	-4.5	0.005	Yes
Revenue Generated (RVN)	-3.6	0.018	Yes

At level, GDP, Freight TON (FRT), and Investment (INV) are not stationary at the 5% significance level. Passengers Carried (PSG) and Revenue Generated (RVN) are stationary at the 5% significance level. After first differencing, all variables become stationary at the 5% significance level. This shows missed stationarity and the need to proceed to the ARDL test.

ARDL (AutoRegressive Distributed Lag) model specification test result for the model:

Table 4.2: Model Specification for Employed Variables

Model Specification	F-statistic	p-value	R-Squared	Adjusted R-Squared	Durbin-Watson	Result
ARDL(1, 1, 1, 1)	4.2	0.012	0.56	0.52	1.8	Significant - Reject Null Hypothesis
ARDL(2, 2, 1, 2)	3.5	0.025	0.48	0.44	2.2	Significant - Reject Null Hypothesis
ARDL(1, 1, 2, 1)	5.1	0.005	0.62	0.58	1.6	Significant - Reject Null Hypothesis
ARDL(2, 1, 1, 2)	3.8	0.018	0.54	0.50	2.0	Significant - Reject Null Hypothesis
ARDL(2, 2, 2, 1)	2.6	0.075	0.38	0.34	2.4	Not Significant - Fail to Reject Null

Different model specifications were tested with various lag lengths for each variable. The F-statistic and associated p-value were used to determine the significance of the model. The null hypothesis is that there is no cointegrating relationship among the variables.

Bound test for the model

Below is the bound test result for the ARDL model:

Table 4.3: Bound Test Result:

Hypothesized Bound	F-statistic	Critical Value (5%)	Result
Lower Bound	3.2	2.3	Significant - Reject Null Hypothesis
Upper Bound	4.8	3.5	Significant - Reject Null Hypothesis

The bounds set for testing the significance of the long-run relationship. The F-statistic is the test statistic for the bound test. It is observed to be greater than the critical value, which shows significant long run relationship between employed variables.

ARDL longrun-result for the model

Presented below is the result for the ARDL long-run relationship:

Table 4.4: ARDL Long-Run Result:

Variable	Coefficient	Standard Error	t-Statistic	Probability
Intercept	0.012	0.005	2.40	0.025
PSG	0.321	0.048	6.68	0.000
FRT	-0.235	0.032	-7.31	0.000
INV	0.002	0.001	1.98	0.052
RVN	0.113	0.023	4.91	0.000

In this ARDL long-run result:

The intercept represents the constant term in the model when all independent variables are zero. In this context, it suggests that even when passengers carried (PSG), freights (FRT), investment (INV), and revenue generated (RVN) are zero, there is still a positive impact on the Gross Domestic Product (GDP). A one-unit increase in passengers carried is associated with a 0.321-unit increase in the Gross Domestic Product (GDP) in the long run. The positive coefficient indicates a positive impact. A one-unit increase in freights is associated with a -0.235-unit decrease in the Gross Domestic Product (GDP) in the long run. The negative coefficient suggests a negative impact. A one-unit increase in investment is associated with a 0.002-unit increase in the Gross Domestic Product (GDP) in the long run. The positive coefficient indicates a positive impact, although it has a relatively small effect. A one-unit increase in revenue generated is associated with a 0.113-unit increase in the Gross Domestic Product (GDP) in the long run. The positive coefficient indicates a positive impact. The model suggests that, in the long run, an increase in passengers carried and revenue generated has a positive impact on the Gross Domestic Product (GDP). However, an increase in freights has a negative impact on the GDP in the long run. Investment also has a positive but relatively small impact on the GDP in the long run.

Implications of the study

Passengers Carried (PSG): An increase in the number of passengers carried by the railway system is associated with a positive impact on the Gross Domestic Product (GDP) in the long run. This could imply that a well-utilized and efficient railway passenger service contributes positively to economic performance.

Freights (FRT): An increase in the transportation of freights by the railway system is associated with a negative impact on the Gross Domestic Product (GDP) in the long run. This suggests that the movement

of goods by rail might have a limiting effect on economic performance, perhaps due to certain challenges or inefficiencies in the freight transportation process.

Investment (INV): An increase in investment in the railway system is associated with a positive, albeit small, impact on the Gross Domestic Product (GDP) in the long run. This implies that increased financial commitment to the railway infrastructure could have a modest positive influence on economic performance.

Revenue Generated (RVN): An increase in the revenue generated by the railway system is associated with a positive impact on the Gross Domestic Product (GDP) in the long run. This suggests that a financially viable and revenue-generating railway system contributes positively to overall economic performance.

The efficient movement of passengers via the railway system seems to have a more pronounced positive impact on economic performance than the transportation of freights. Increased investment in railway infrastructure is seen as beneficial for economic performance, although the effect is relatively small. A financially sustainable railway system, as indicated by higher revenue generation, contributes positively to economic performance.

The result aligns with the theory of transportation infrastructure contributing to economic development. According to the literature, investments in transportation infrastructure, including railways, can have positive effects on economic growth. The positive impact of passengers carried on GDP aligns with the idea that efficient passenger transportation can enhance mobility, connectivity, and accessibility, leading to increased economic activities (Chen, 2018). The negative impact of freights on GDP might be attributed to potential challenges or inefficiencies in the freight transportation process. However, it's important to note that this finding contradicts some conventional expectations, and further investigation would be needed to understand the underlying dynamics. The positive impact of investment on GDP supports the theory that increased financial commitment to transportation infrastructure, such as railways, can stimulate economic development (Ayoola & Yusuf, 2023). The positive impact of revenue generated on GDP is consistent with the notion that a financially viable and sustainable transportation system contributes positively to overall economic performance (Finger, 2016).

5. CONCLUSION AND RECOMMENDATION

The results indicate a mixed impact of various factors related to railway transportation on Gross Domestic Product (GDP). While the findings align with some expectations based on economic theories, there are also unexpected results that require further investigation. The positive impact of passengers carried on GDP suggests that an efficient and effective passenger transportation system contributes positively to economic growth. This aligns with the notion that improved mobility for individuals can lead to increased economic activities. The negative impact of freights on GDP is unexpected and warrants careful consideration. It could be an indication of challenges or inefficiencies in the freight transportation process that might need attention to ensure a positive contribution to economic growth. The positive impact of investment on GDP supports the economic theory that increased financial commitment to transportation infrastructure, such as railways, can stimulate economic development. This implies that strategic investments in the railway system can have positive long-term effects on the overall economy. The positive impact of revenue generated on GDP suggests that a financially viable and sustainable railway system contributes positively to economic performance. This reinforces the importance of a well-managed and financially sound railway sector in fostering economic growth.

In conclusion, the findings emphasize the significance of a well-functioning railway system for economic development. Strategic investments in both passenger and freight transportation, coupled with effective management and revenue generation, can positively influence the economic performance of a country. However, the unexpected negative impact of freights on GDP requires further exploration and understanding of the underlying dynamics to optimize the contribution of the freight transportation sector to overall economic growth.

Based on the Findings, the following recommendations are proposed:

i. Railway operators, transport authorities, and regulators should collaborate to enhance the efficiency and accessibility of passenger railway services. Investments and initiatives should be coordinated among these stakeholders to achieve the desired improvements.
ii. Collaboration among railway operators, freight companies, and regulatory bodies is crucial. In-depth analysis and improvements in freight transportation processes should involve a joint effort to streamline operations and address inefficiencies.
iii. Government bodies, railway operators, and investors should work together to ensure sustained and increased investments in railway infrastructure projects. Collective decision-making and prioritization of projects aligned with the overall development goals are essential.
iv. Railway operators, government authorities, and potential private partners should collaborate to implement revenue-enhancing strategies. Public-private partnerships can be particularly effective, requiring joint efforts in planning and execution.
v. Stakeholders should launch public awareness campaigns to educate the population on the benefits of railway transportation. They should also build public support for railway projects and initiatives through transparent communication.
vi. Overall, to maximize economic benefits, sustained investment, public-private partnerships, and technological adoption are recommended. The National Railways Modernization Project should be expanded and supported for comprehensive sector development.

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