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Evaluating the Impact of Urbanization on Road Traffic Accidents: Insights from Lagos, Nigeria

Ahmed Oyeyemi[1], Adebakin Osoja[2], Opeyemi Fadipe[3], Olasunkanmi O. Olasokan[4]

[1]Department of Transportation and urban infrastructure systems, Morgan State University, Baltimore, Maryland, USA.
[2]Department of transportation and urban infrastructure systems, Morgan State University, Baltimore, Maryland, USA
[3]Department of Industrial Systems Engineering, Morgan State University, Baltimore, Maryland, USA.
[4]Registry Department, Lagos State University of Science and Technology, IKorodu, Lagos Nigeria

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***Corresponding Author:** Olasunkanmi O. Olasokan

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Abstract **Original Research Article**

Urbanization has emerged as a double-edged swordwhile it fosters economic development and improved infrastructure, it also introduces significant challenges to urban mobility and road traffic safety. This study evaluates the correlation between urbanization and road traffic accidents (RTA) in Lagos, Nigeria, by investigating three key independent variables: urban population (UP), Population Growth Rate (PGR), and Number of Registered Vehicles (NRV). Utilising Ordinary Least Squares (OLS) regression analysis, the research reveals that the intercept value is 2298.304, indicating the average number of traffic accidents when all independent variables are zero. The findings demonstrate a positive correlation between urban population and traffic accidents, with each unit increase in urban population leading to a 0.000103 increase in accidents. Conversely, a unit increase in Population Growth Rate (PGR) corresponds to a decrease of approximately 1054.918 in accidents, suggesting that higher population growth rates may be associated with improved traffic management. Additionally, each unit increase in Number of Registered Vehicles (NRV) results in an increase of 0.000404 in accidents, although its impact is less significant than that of UP. Model fit analysis indicates an R-squared value of 0.700180, explaining about 70.02% of the variance in traffic accidents, while the adjusted R-squared of 0.820288 confirms the model's robustness. The F-statistic of 3.892228 suggests reasonable explanatory power, despite a p-value of 0.088818 indicating marginal significance at the 10% level. Auto-correlation analysis, represented by a Durbin-Watson statistic of 2.584097, indicates no significant autocorrelation in the residuals, reinforcing the model's validity. These findings underscore the complexities of urbanization's impact on road safety and highlight the need for targeted interventions to mitigate traffic accidents in rapidly urbanizing areas such as Enhance Traffic Management Systems by Expanding Existing Safety Measures, Smart Traffic Solutions, Sustainable Urban Planning and Infrastructure Development, Public Transport Improvements, Community Awareness and Education, Regular Data Collection and Analysis, Policy Development and Implementation, Collaboration with Stakeholders. By implementing these recommendations, Lagos can enhance its road safety measures, improve traffic management, and reduce the incidence of road traffic accidents amidst ongoing urbanization.

Keywords: Urbanization, road traffic accidents, Lagos, vehicle density, infrastructure, traffic management.

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1. INTRODUCTION

Cities are becoming thriving hubs of social, cultural, and economic activity due to the irreversible worldwide trend of urbanization (Bibri, 2021). Rural inhabitants' migration to the metropolis has fueled the unheard-of urban growth, which offers citizens opportunities but also presents difficulties as residents, legislators, and urban planners work to maintain environmental sustainability. Based on land size, Nigeria is the 32nd biggest nation in the world, with around 923,768 square kilometres (Koko et al., 2020). With an estimated population of 213 million, the country is also the seventh most populous in the world (National Bureau of Statistics, 2019). Nigeria is expected to become the fourth most populous country in the world by 2050, when its population is expected to exceed 440 million (Desa, 2020).

The socio-economic progress and environmental sustainability of emerging nations like Nigeria are severely impacted by urbanization because they are ill-equipped to manage the rapid population rise (Idowu, 2013). Therefore, the main causes of urbanization in Nigeria are determined to be infrastructure, commerce, politics, industrialisation, and the establishment of states. These elements, in turn, promote migration from rural to urban areas, urban population increase, lifestyle convergence, and urbanization-related economic expansion. With more than half of the world's population currently living in urban areas, particularly in developing countries, the 21st century saw a major urbanization (Osoja et al., 2023).

Lagos, which has a 14th-century history, is leading the way in Nigeria's urbanization. According to the United Nations Department of Economic and Social Affairs (2019), the state is one of the cities with the fastest rates of urban growth in the world. The forecast that Lagos City's population would increase at a pace of 77 persons per hour between 2010 and 2030, solidifying its status as Africa's fastest-growing city, highlights the development trend even more (Hoornweg & Pope, 2016). It is impossible to overstate the difficulties associated with transit in Lagos, which has recently seen significant urbanization and interrelated issues such as poor infrastructure, environmental degradation, social inequality, and resource shortages (Olasokan and Toki, 2021). Given that people will always need to travel between locations for a variety of activities, this fast expansion has resulted in a surge in transportation-related activities.

Olasokan and Toki (2021) define transportation as the movement of people, products, and services between locations. Additionally, it is a necessary component of socioeconomic growth, which is crucial for any community anywhere in the world. According to Ravallion (2016), transport is a crucial system that improves the pattern of settlement growth by channelling, directing, championing, and redirecting. Globally, urbanization has been connected to traffic accidents, which continue to be a problem for Lagos State's public safety. The Lagos Traffic Management Authority (LASTMA) reported 2,051 traffic accidents in 2024, involving 3,754 cars; prompt action prevented 1,075 fatalities. LASTMA also took care of 5,108 vehicle breakdowns, including 1,649 trucks, four hundred tankers, and five hundred and thirty-five trailers. Road safety issues are raised by these situations, which frequently result in secondary dangers, including traffic jams and more collisions, highlighting the significance of prompt and efficient response procedures (ref). With an emphasis on the connection between urban expansion and accident patterns, this study aims to assess how urbanization has affected traffic accidents in Lagos.

1.2 Study Area

Lagos is situated on the Atlantic coast of South-Western Nigeria, between latitudes 6°15´N and 6°41´N and longitudes 2°42´E and 4°14´E on the West Coast of Africa, as seen in Figure 1. With an area of around 3,577 square kilometres (sq. km), or 0.4% of the nation's total landmass, it is the smallest state in Nigeria (Auwalu et al., 2021). Twenty Local Government regions (LGAs) make up Lagos, sixteen of which are classified as high-density metropolitan regions (Ndidi & Nduka, 2014). Located on a large lowland and island, Lagos is often referred to as Greater Lagos or the Lagos Metropolitan Area. It is a bustling port city with over 220.6 square kilometres of water bodies, mangrove swamps, and wetlands. Nigeria's largest city and most significant economic hub, Lagos and its surrounding metropolis are home to the nation's main seaports.

Lagos is responsible for more than 90% of Nigeria's commercial flow and 10% of the country's GDP, according to Gbenga (2023). With 65% of Nigeria's industrial sector based in the city, it has the sixth biggest economy in Africa. According to Lawanson and Agunbiade (2018), Lagos boasts a broad and dense network of towns and urban areas connected by several road networks. Lagos City's unplanned and chaoticurbanizationand infrastructure, which are deemed insufficient and failing, are characteristics of the city's rapidly expanding population (Wang &Lu,) 2018).

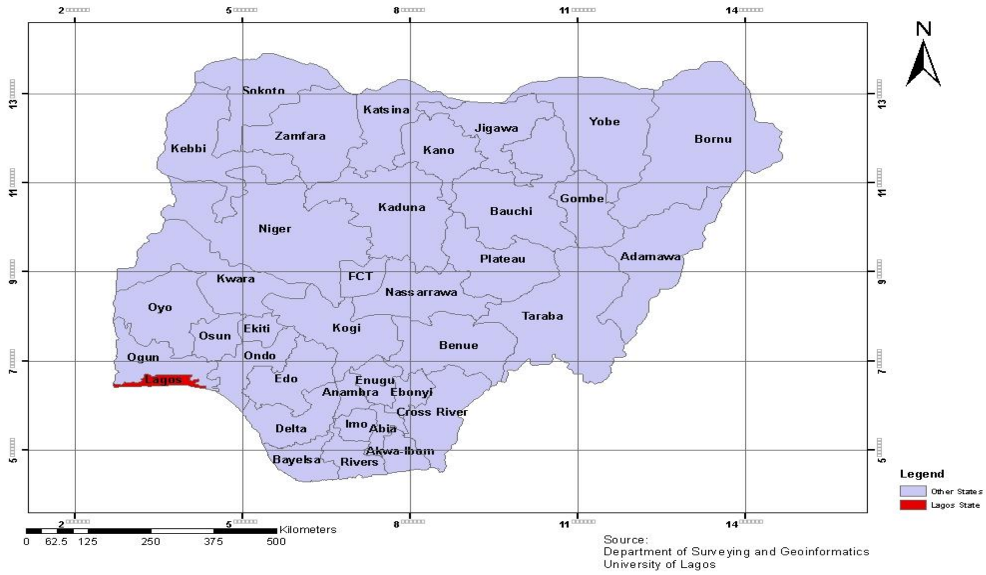

Figure 1.1: Lagos within the context of Nigeria
Source: Lagos State Physical Planning Permit Authority.

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

2.1.1 Traffic Congestion

Due to the infrastructure's limited capacity, road traffic congestion is inevitable when users of a given facility start to obstruct other users (Van Oort, 2011). On a motorway, traffic congestion happens when the vehicle density exceeds a specific threshold. Adding a single vehicle to a route that is already saturated would cause "dead weight," or traffic congestion. It will become uncertain how long it takes to go between two places on the route in question because of the sharp decline in dead weight, vehicle speed, and vehicle flow. Other connected issues include increased auto-induced pollution, excessive fuel usage, and variable transportation costs (Buton 2010). These phenomena are also discernible on the highways of Lagos.

According to Ikpong (2016), traffic congestion occurs when the amount of traffic on an urban road network becomes too great for it to manage. This condition is typically brought on by the rapid increase in motorisation and the underwhelming advancements in the road system and associated infrastructure. Akinboro, Adeyiga, Johnson, Omotosho, and Adebayo (2017) concurred, however, that traffic congestion often leads to an instance in which an excessive number of automobiles occupy the same amount of accessible road space at a particular moment. Similarly, Rao & Rao (2014) (Mabogunje, 2018) claimed that congestion is one of the most significant aspects of transportation supply. To put it another way, the demand for travel increases as more roads are built as a solution to traffic.

2.1.2 Urbanization

Numerous studies have examined how urbanization affects traffic safety. Higher accident rates are substantially correlated with both vehicle ownership and population density. Because of its diversified population and intricate transportation dynamics, Lagos offers a unique background that calls for a thorough examination of these elements. The term "urbanization" describes "the gradual increase in the proportion of people living in urban areas," the population movement from rural to urban areas, and the methods by which each society adjusts to the change. By 2050, 86% of the developed world and around 64% of Africa and Asia are expected to be urbanised (The Economist, 2012). Notably, the UN recently predicted that cities will absorb all of the world's population increase between 2017 and 2030, adding around 1.1 billion more urbanites over the next 13 years (Barney, 2015).

2.2 Literature Review

Development dates back to the first cities in Mesopotamia and Egypt. Up until the 18th century, there was a balance between the large majority of people living in rural areas and working in subsistence agriculture and small population centres in towns, where the main sources of economic activity were small-scale manufacturing and market trade. The ratio of rural to urban population stayed at a stable balance throughout this time due to agriculture's rudimentary and comparatively stationary nature. Additionally, a notable rise may be attributed to Mughal India, where, in the 16th and 17th centuries, 15% of the population resided in urban areas, which was greater than the rate in Europe at the time (Abraham, 2007; Paolo, 2009). In the West, urbanization grew quickly, and since the 1950s, it has also started to expand to Asia and Africa. Only 15% of people on Earth lived in cities at the turn of the 20th century.

2.2.1 Effects of urbanization

Urbanization has significantly affected the people and the society. The effect can be categorised into the following:

1. **Economic Effect:** Given that individuals must exist on the excessive cost of commodities, an increase in the population in cities causes a sharp rise in prices. According to Grant (2008), think tanks like the Overseas Development Institute have suggested policies that promote labour-intensive growth in order to absorb the flood of unskilled and low-skilled labour. Due to economic prospects in urban regions, low-skilled or unskilled migrant workers from rural areas sometimes end up living in slums since they are unable to obtain employment and afford accommodation in cities (Benedictus, 2017). Although the trend for core cities in emerging countries tends to continue becoming denser, urban issues and infrastructural advancements are also contributing to the suburbanization tendencies in these countries. Urban living enables people and families to benefit from the advantages of diversity and closeness (Brand, 2009).
2. **Health and Social Effects:** Life expectancy does not significantly rise with urbanization in nations across Asia and Africa. Depending on the disease and the area, there are variations in the death rate from infectious diseases (Eckert and Kohler, 2014). Generally speaking, urban regions have higher health standards than rural ones. Nonetheless, those who live in impoverished urban settings like slums and informal settlements experience "disproportionately high rates of illness, injury, and early mortality, and the combination of poverty and poor health eventually entrenches disadvantage" (Allender et al., 2008). The impact of globalization and urbanization on health has been researched by agriculturists. Fast food is frequently the preferred food, which is contributing to the health deterioration (Dionne, 2020). Less healthy eating habits might result from easier access to non-traditional foods (Sridhar, 2007).
3. **Environmental Effects:** The occurrence of urban heat islands has grown over time. Even more heat is released by industries, automobiles, and home and commercial heating and cooling systems (Glaeser, 1998). Consequently, urban areas are frequently 1 to 3 degrees Celsius (1.8 to 5.4 degrees Fahrenheit) warmer than their natural surroundings (Park, 1987). The

United Nations Department of Economic and Social Affairs stated in a July 2013 study that by 2050, there would be 2.4 billion additional people, particularly in nations where food insecurity is already a problem as a result of changing environmental circumstances (Jiang et al., 2008). The study's foundation is traffic accidents, which are one of the biggest issues facing metropolitan communities worldwide.

2.2.2 The causes of road traffic accidents

Traffic accident depends on several factors, according to (Olasokan et al., 2019), which can be divided into:

i. Vehicle operator or driver factors
ii. Vehicle factors
iii. Road pavement condition factors
iv. Environmental factors.

i. Vehicle operator or Driver factors:

In traffic accidents, driver factors include all elements pertaining to drivers and other users of the road. In contrast to TRACE's findings, research, and documentation of traffic accidents in Nigeria have unequivocally demonstrated that the attitude of Nigerian drivers towards driving codes and etiquette is the most significant contributing factor. Driver factors alone account for roughly 57% of traffic accidents, while other factors account for 93% of them. Overspeeding is one of the drivers' problems. Both the probability of a collision and the seriousness of its aftermath are closely correlated with an increase in average speed. Drug use and drunk driving raise the chance of a traffic collision and the possibility of death or severe injury.

Some drivers frequently become distracted while driving, and this can occasionally be linked to using mobile phones. Concerns over road safety is developing as a result of the recent noticeable growth in drivers' usage of mobile phones worldwide. Mobile phone distraction can affect driving performance in a variety of ways, including reduced following distances, longer response times (particularly brake reaction time, but also responsiveness to traffic signals), and difficulty maintaining the proper lane. Additionally, text messaging significantly impairs driving performance, and young drivers are especially vulnerable to the distracting consequences of this use.

The majority of Nigerian drivers are untrained to operate motor vehicles on public roads and lack the proper authorisation from government-approved organisations such as the Federal Road Safety Commission, or FRSC. This is the primary cause of the majority of Nigerian drivers' ignorance of highway traffic signals. They endanger their own lives as well as the lives of other drivers. Additionally, wearing seatbelts helps to keep the driver comfortable and upright so that they can operate the vehicle as intended. However, there is a greater chance of death for both front-seat and rear-seat passengers due to the severe misuse of this safety mechanism.

ii. Vehicle factors

An important consideration while examining the remote causes of a traffic accident is the car itself, which is equipped with devices such as horn, side mirrors, wipers, braking system, trafficators, headlights, and brake-lights, to name a few, to prevent accidents. Any vehicle component, including the tires, engines, brake, and lighting systems, can malfunction and result in roadtraffic accidents. The car's condition at any given time determines the credibility of the vehicle. The two primary elements influencing vehicle factors about the causes of traffic accidents are vehicle maintenance and vehicle components. The likelihood of a traffic collision depends on if the vehicles constructed parts function as a cohesive unit or not.

A vehicle's stability on the road surface is mostly determined by the precise maximum load that is designed for it in all of its ramifications. Deterioration of the vehicle's condition in rapid wear and tear occurs when it is subjected to stress beyond the parameters of the design requirements, as is the situation with many automobiles on Nigerian roads. Design flaws have an impact on the vehicle's future state once it is put on the road and driven regularly or differently, which might lead to traffic accidents. Furthermore, brakes are typically applied to wheels or spinning axles. As the primary means of synchronising their speeds, cars employ a mix of brake and accelerator systems. Any braking subsystem fault should be treated carefully as it might lead to an inevitable collision.

Although less obvious, a vehicle's structural rigidity can contribute to road traffic accidents, however, tyres are one of the main components that determine a vehicle's stability and safety when driving. It is not the case that tires made for cold climates, such as Nigeria, are made for temperate climates. This is not the case for the majority of tires used in Nigeria, though, since when car owners purchase and install tires on their cars, they often fail to consider the tire specifications, which can result in tire ruptures and traffic accidents.

One of the main causes of road accident is a malfunctioning car lighting system. Vehicle lights that go out have a propensity to mislead and misinform other drivers, which increases the likelihood of accidents. During the day, at night, and in inclement weather, vehicle lights are quite helpful. An accident may occur if, for instance, the driver of the vehicle behind fails to allow for a sufficient stopping sight distance or if the vehicle has a malfunctioning brake sub-system. For instance, a vehicle ahead of you with a failed trafficator light will typically not give other vehicles behind you the usual warning that it is about to perform a turning manoeuvre.

The engine subsystem is the vehicle's powerhouse and heart. It is in charge of starting other elements of the vehicle, and, if it fails suddenly on a highway with a high enough traffic flow at that moment, it is more likely to result in an accident. Even in situations with little traffic, an experienced driver's poor handling of the situation might result in a collision. It is insufficient to just purchase a well-designed car and put it on the road to stop it from causing an accident. Since a well-maintained car is less likely to be involved in an accident, neglecting to undertake periodic maintenance and inspections on the vehicle can cause the subsystems to deteriorate and increase the risk of a traffic accident.

iii. Road pavement condition factors

Due to their sometimes-poor design, inadequate provision of essential road amenities like drainage, infrequent rehabilitation, and deterioratedcondition, Nigerian highways are undoubtedly among the worst and most hazardous in the world. Vehicles and other road users are vulnerable to road traffic accidents due to the terrible conditions of Nigeria's roadways. This demonstrates even further that human mistakes and carelessness on the part of drivers are not the only causes of traffic accidents.

iv. Environmental factors

The rate of road accidents in Nigeria nowadays is significantly influenced by environmental factors as fog, sun, mist, and rain. As previously said, the majority of cars on Nigerian roads are not well-maintained. For instance, if the wipers are broken and not working on a wet day, the driver would not be able to see ahead, increasing the likelihood of a traffic collision.

2.3 Theoretical Framework

2.3.1 Systems concept

An interdisciplinary framework called Systems Concept Theory sees complex phenomena as systems made up of interdependent elements. A system is defined as a collection of components that interact with one another, play together, or come together to form a regular, interconnected whole (Kirk Patrick, Chambers, 20th century Dictionary). A system idea is a way of looking at a phenomenon (such as items) and illustrating how they relate to one another through a process, to first comprehend the phenomenon and then regulate and optimise it or its component processes. In the majority of social science research, the system notion is a crucial idea.

A thorough grasp of the intricate relationships between different factors influencing traffic safety, such as expanding existing safety measures, smart traffic solutions, sustainable urban planning and infrastructure development, public transport improvements, community awareness and education, regular data collection and analysis, policy development and implementation, and traffic management strategies and safety measures, can be gained by applying Systems Concept Theory to the study of urbanization on road traffic accident in Lagos Nigeria.

3. METHODOLOGY

3.1 Research Design and Sources of Data

The design is a framework or blueprint that guides the execution of research work. For this research, the researchers used secondary data by subjectively citing the various authors for the objectivity of the data. The major determinant of an econometric analysis is the availability of relevant and accurate data, which determines whether an econometric analysis is successful (Gugarati, 2003). Therefore, statistical publications on Traffic accidents were obtained from the National Traffic Accident Report. Urban Population Data was obtained from the National Population Commission (NPC), Population Growth Rate is the population difference in each year, while data on registered vehicles was obtained from the Lagos State Vehicle Registration Authority (LASVEB). The various obtained data is between (2015-2024).

3.3 Model Specification

The detailed model shows the relationship between the various variables. The Included are Traffic Accident, Urban Growth Rate, Population Growth rate and number of registered vehicles.

The model is specified as follows:

$TRAFFA = f(UGR, PGR, NRV)$………………………………… (1)

Where:

$TRAFFA =$ Traffic Accident

$UP =$ Urban Population

$PGR =$ Population Growth rate

$NRV =$ Number of Registered Vehicles

Assuming a linear relationship among explanatory variable the explicit form of equation (1) becomes:

$TRAFFA_t = \beta_0 + \beta_1 UP_t + \beta_2 PGR_t + \beta_3 NRV_t + \mathcal{E}_t$…………………………… (2)

$TRAFFA =$ Explained or dependent variable

$UP =$ Explanatory variable or independent variable

$PGR =$ Explanatory variable or independent variable

$NRV =$ Explanatory variable or independent variable

3.4 Data Analysis Techniques

The econometric software, called Econometric-View 12 for Windows (E-view 12), was used to process the data obtained and scrutinise it for the research. The information obtained was extracted into tables and other forms. Descriptive analysis was conducted to examine the relationship between the explanatory and dependent variables. Based on this, a multiple regression analysis model was used to assess the proxy variables for traffic accidents on the one hand and variables relating to urban population, population growth rate and number of registered vehicles on the other hand. The model is estimated using Ordinary Least Squares (OLS) methods.

The model's statistical significance, both individually and collectively, was evaluated with equivalent significance; both the t-statistic and the f-statistic are employed. It makes use of both the t-statistic and the F-statistic. The serial correlation test was based on the Durbin-Watson statistic. The model's goodness of fit is evaluated using the coefficient of determination (R2), which is the adjusted R2 after considering the degree of modification. Because the hypothesis was evaluated at the 5% and 1% levels of significance, the study's findings could only be extrapolated to the degree that they were discovered.

The following procedures are included in our data analysis since the study employs secondary data from time series: unit root tests are used to determine the stationarity of the model's variables' temporal features. Engle-Granger's single equation test was used to determine whether there is a long-term equilibrium relationship between the variables or whether the variables in the equation are co-integrated. Several diagnostic tests were also used to evaluate the significance and dependability of the empirical model, such as the F-test, the t-test, the t-test for correlation, the standard error test, and the serial autocorrelation test.

4.0 RESULT AND DISCUSSION

4.1 Descriptive Statistics

Descriptive statistics will be used to summarise and organise the data in a meaningful way. It provides simple summaries about the sample and the measures. The descriptive statistics table is presented below:

Table 4.1: Descriptive Statistics Table

	TRAFFA	**UP**	**PGR**	**NRV**
Mean	347.7000	14238200	3.427000	468410.1
Median	345.0000	14136000	3.390000	417531.0
Maximum	441.0000	16536000	3.750000	789280.0
Minimum	227.0000	12239000	3.230000	154056.0
Std. Dev.	72.41861	1439068.	0.201663	229989.2
Skewness	-0.206061	0.178599	0.509025	0.162653
Kurtosis	1.817640	1.822224	1.730325	1.520725
Jarque-Bera	0.653258	0.631144	1.103542	0.955867
Probability	0.721351	0.729372	0.575929	0.620064

Sources: Computed by Author using E-views 10, 2025

Mean Values of the analysis are as follows: TRAFFA: 347.7000, UP: 14,238,200, PGR: 3.4270 and NRV: 468,410.1. The mean values indicate the average for each variable. TRAFFA has a mean of 347.7, UP has a significantly higher mean, suggesting it is a larger scale measure, while PGR and NRV show moderate averages relative to their respective scales. The Skewness value is as follows: TRAFFA: -0.206061 (slightly negatively skewed), UP: 0.178599 (slightly positively skewed), PGR: 0.509025 (moderately positively skewed) and NRV: 0.162653 (slightly positively skewed). This implies that Negative skewness for TRAFFA suggests a longer tail on the left, indicating that more data points are concentrated on the higher end, and Positive skewness for UP, PGR, and NRV indicates that these distributions have longer tails on the right, meaning a few high values are pulling the mean up. The Kurtosis statistics value is TRAFFA: 1.817640, UP: 1.822224, PGR: 1.730325 and NRV: 1.520725. This implies that all variables have kurtosis values less than 3, indicating platykurtic distributions. This means the distributions are flatter than the normal distribution, with fewer outliers and a wider peak.

Jarque-Bera Test value is TRAFFA: 0.653258, UP: 0.631144, PGR: 1.103542 and NRV: 0.955867. The Jarque-Bera statistic helps to test for normality. Values close to 0 suggest that the data is normally distributed. All values here are low, indicating that none of the variables significantly deviate from normality. The probabilities associated with the Jarque-Bera test indicate the p-values for testing normality. All values are above the typical significance level of 0.05, suggesting that we fail to reject the null hypothesis of normality for all variables as represented in Table 4.1 above.

4.2 Unit Root Test

In line with recent developments in time series modelling, unit root tests of the time series properties of the data are examined to determine the order of integration of the variables used in the model. A series is said to be integrated of order d, denoted I(d), if the series becomes stationary or I(0) after being differenced d times. The Dickey-Fuller-GLS tests are performed. The statistics of the tests allow one to test formally the null hypothesis that a series is I (1) against the alternative that it is I (0). The results of the stationarity tests for the variables are presented in Table 4.2.

Table 4.2: Unit Root Test Statistical Table

		Critical Value			
VARIABLE	**ADF Test Statistic**	**1%**	**5%**	**10%**	**ORDER OF INTEGRATION**
TRAFFA	-2.705965	-5.2459	-3.5507	-2.9312	I(1)
UP	-2.670056	-5.2459	-3.5507	-2.9312	I(1)
PGR	-3.723333	-5.2459	-3.5507	-2.9312	I(1)
NRV	-4.513783	-5.2459	-3.5507	-2.9312	I(1)

Sources: Computed by the Author using E-views 12, 2025

The Unit Root Test analysis results reveal ADF Test Statistics as follows: TRAFFA: -2.705965, UP: -2.670056, PGR: -3.723333, NRV: -4.513783, Critical Values at 1% Level: -(5.2459), 5% Level: (-3.5507) and 10% Level: (-2.9312). The Augmented Dickey-Fuller (ADF) test is used to determine whether a time series has a unit root, which implies it is non-stationary. A negative test statistic indicates the rejection of the null hypothesis of a unit root (non-stationarity). Comparison against Critical Values: Each ADF test statistic is compared against the critical values at different significance levels (1%, 5%, and 10%).

RESULTS ANALYSIS:

TRAFFA: ADF Statistic: (-2.705965), this value is above the critical values at all levels, meaning we fail to reject the null hypothesis of a unit root. Therefore, TRAFFA is likely non-stationary. UP: ADF Statistic: (-2.670056), Similar to TRAFFA, this statistic is also above all critical values, indicating that we fail to reject the null hypothesis. UP is likely non-stationary. PGR: ADF Statistic: (-3.723333), this statistic is below the critical value at the 5% level (-3.5507) but above the 1% level (-5.2459). Hence, we reject the null hypothesis at the 5% level, suggesting that PGR may be stationary. NRV: ADF Statistic: (-4.513783). This value is below the critical values at both the 1% and 5% levels. Thus, we reject the null hypothesis at both levels, indicating that NRV is stationary.

4.3: Co-Integration Test

Co-integration is used to identify whether non-stationary time series move together over the long term. Co-integration tests are powerful tools in econometrics and time series analysis, providing insights into long-term relationships between variables, improving model specifications, and informing economic and financial decision-making. When variables are co-integrated, using them in a regression model can yield more accurate and reliable results. This is because co-integrated variables share a common stochastic trend. The co-integration table is presented below:

Table 4:3 Johansen Maximum Likelihood Co-Integration Test Results

					Critical value	
Variable	**H_O**	**H_A**	**Eigenvalue**	**Likelihood Ratio**	**1%**	**5%**
TRAFFA	r = 0	r = 1	0.486272	5.328489	6.65	3.76
UP	r = 0	r = 1	0.667406	8.806656	6.65	3.76
PGR	r = 0	r = 1	0.127881	1.094633	6.65	3.76
NRV	r = 0	r = 1	0.120645	1.028535	6.65	3.76

Note: r represents number of co-integrating vectors.

Source: Computed by the Author using E-views 12, 2025.

Co-integration tests, such as the Johansen test, are used to determine whether a group of non-stationary time series variables are co-integrated, meaning they share a long-term equilibrium relationship even though they may be non-stationary in their series. The analysis reveals eigenvalues as follows: TRAFFA: 0.486272, UP: 0.667406, PGR: 0.127881, NRV: 0.120645. Critical Values 1% Level: 6.65 and 5% Level: 3.76

The Eigenvalues indicate the strength of the co-integration relationship. Higher eigenvalues suggest stronger co-integration among the variables. Here, UP has the highest eigenvalue (0.667406), indicating a strong potential for co-integration. TRAFFA also shows a significant eigenvalue (0.486272). In contrast, PGR (0.127881) and NRV (0.120645) have much lower eigenvalues, suggesting weaker relationships. The critical values (1% and 5%) are used to determine whether the eigenvalues are statistically significant. To assess the co-integration rank, we would typically compare the trace statistics calculated from the eigenvalues against the critical values.

In Summary, TRAFFA and UP show strong potential for co-integration, indicating a likely long-term relationship between these variables. PGR and NRV exhibit weaker relationships and may not contribute significantly to a co-integrated relationship. To confirm co-integration, further analysis using trace or maximum eigenvalue statistics is necessary to compare against the critical values provided. If the results support co-integration, it implies that while these variables may drift apart in the short term, they tend to move together eventually.

4.4 Presentations of Regression Results

Using the Ordinary Least Squares (OLS) regression method, the following estimated equation was obtained with Econometric Views Computer Package [E-views]. The table below shows the analysis of the result of the data used in the study. The method of analysis employed is the Ordinary Least Square (OLS).The Gross Domestic Product of the Transportation industry is presented as follows:

Table 4.4: Ordinary Lest Square Statistic Table

Dependent Variable: TRAFFA				
Method: Least Squares				
Date: 07/28/25 Time: 08:22				
Sample(adjusted): 2016 2024				
Included observations: 9 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2298.304	948.6720	2.422654	0.0599
UP	0.000103	8.75E-05	1.172660	0.2938
PGR	-1054.918	640.7873	-1.646285	0.1606
NRV	0.000404	0.000126	3.195901	0.0241
R-squared	0.700180	Mean dependent var		339.5556
Adjusted R-squared	0.820288	S.D. dependent var		71.78982
S.E. of regression	49.72250	Akaike info criterion		10.95189
Sum squared resid	12361.64	Schwarz criterion		11.03955
Log likelihood	-45.28353	F-statistic		3.892228
Durbin-Watson stat	2.584097	Prob(F-statistic)		0.088818

Sources: Computed by the Author using E-views 12, 2025

The result of the Ordinary Least Squares (OLS) is presented as follows: Constant (C), which represents the intercept, has a value of 2298.304, which suggests that when all independent variables: Urban Population, Population Growth Rate, and Number of Registered Vehicles are zero, the dependent variable's average value is approximately 2298.304. Urban Population (UP) value indicates that, for every unit increase in UP, the dependent variable Traffic Accident (TRAFFA) increases by 0.000103, holding other variables constant, indicating a positive relationship.

Population Growth Rate (PGR) reveals that a unit increase in PGR results in a decrease of approximately 1054.918 in the dependent variable (Traffic Accident), indicating a strong negative relationship. Number of Registered Vehicles (NRV) indicates that, for every unit increase in NRV, the dependent variable (Traffic Accident) increases by 0.000404, suggesting a positive relationship, but the effect is much smaller compared to Urban Population.

The R-Squared and Adjusted R-Squared

R-squared (0.700180), which indicates that approximately 70.02% of the variance in the dependent variable is explained by the independent variables in the model. This suggests a robust fit, meaning that the model captures a significant portion of the variability present in the dependent variable. **Adjusted R-squared (0.820288),** this value adjusts the R-squared for the number of predictors in the model, providing a more accurate measure of model fit. The adjusted R-squared of 82.03% indicates that a substantial proportion of the variance is explained, even after accounting for the number of predictors. The fact that this value is higher than the R-squared suggests that the model is well-specified, and the independent variables included contribute meaningfully to explaining the variance.

F-statistic

F-statistic (3.892228), this statistic tests the overall significance of the regression model. A higher F-statistic indicates that the model explains a significant amount of variance compared to a model with no predictors. The F-statistic suggests a reasonable level of explanatory power for the model. **Prob(F-statistic) (0.088818),** this p-value indicates the probability of observing the F-statistic as extreme as the calculated value under the null hypothesis (which states that none of the predictors are significant). A value of 0.088818 suggests marginal significance at the 10% level, but it does not reach significance at the 5% level. This implies that there is some evidence that the independent variables collectively influence the dependent variable, but the evidence is not strong enough to assert statistical significance at conventional levels.

Durbin-Watson Statistic

Durbin-Watson statistic (2.584097), this statistic tests for autocorrelation in the residuals from the regression analysis. Values around 2 indicate no autocorrelation, while values below 1 or above 3 suggest positive or negative autocorrelation, respectively. A value of 2.584 indicates that there is no significant autocorrelation present in the residuals, which is a positive sign for the validity of the model's results.

5.0 SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Summary of Findings

This study investigated the relationship between urbanization and road traffic accidents (TRAFFA) in Lagos, Nigeria, focusing on three key independent variables: Urban Population (UP), Population Growth Rate (PGR), and Number of Registered Vehicles (NRV). The research engages Ordinary Least Squares Regression Analysis, which reveals a constant (C) that is an intercept value of 2298.304, indicating that when all independent variables are zero, the average number of traffic accidents is approximately 2298.304. Urban Population (UP): For every unit increase in urban population, traffic accidents increase by 0.000103, indicating a positive correlation between urban population growth and accident rates.

Population Growth Rate (PGR): A unit increase in PGR results in a decrease of approximately 1054.918 in traffic accidents, suggesting a strong negative relationship. This finding suggests that higher population growth rates correlate with better traffic management or safety measures, which is evident in the effort of the Lagos state government over the years, various measures adopted in the reduction of traffic accidents, such as speed limit devices, installation of Closed-Circuit Television (CCTV) on major highways to monitor vehicular speed. Number of Registered Vehicles (NRV): Each unit increase in registered vehicles leads to an increase of 0.000404 in traffic accidents. While this shows a positive relationship, its effect is smaller compared to UP.

The Model Fit analysis reveals an R-squared value of 0.700180, which indicates about 70.02% of the variance in traffic accidents, is explained by the independent variables, while the remaining 30% is explained by other variables, which indicate a robust model fit. The adjusted R-squared value of (0.820288) suggests a substantial proportion of the variance is explained even after adjusting for the number of predictors, indicating that the model is well-specified and that the included variables contribute meaningfully to the explanation.

The overall Model Significance indicates an F-statistic value of 3.892228, indicating that the model explains a significant amount of variance compared to a model with no predictors, reflecting reasonable explanatory power. Prob(F-statistic) (0.088818). The p-value suggests marginal significance at the 10% level, indicating some evidence that the independent variables collectively influence traffic accidents, but not strong enough to assert significance at the 5% level. Autocorrelation analysis reveals a Durbin-Watson Statistic value of 2.584097; a value around 2 indicates no significant autocorrelation in the residuals, which supports the validity of the model's results.

5.2 Recommendations

Based on the findings from the study investigating the relationship between urbanization and road traffic accidents (TRAFFA) in Lagos, Nigeria, the following recommendations are proposed to enhance road safety and reduce traffic accidents:

1. **Enhance Traffic Management Systems by Expanding Existing Safety Measures**: The research recommends the continued improvement and expansion of the existing traffic management initiatives, such as speed limit enforcement, installation of more Closed-Circuit Television (CCTV) cameras, and implementation of traffic signal systems to better monitor and manage vehicle speeds on major highways.
2. **Smart Traffic Solutions**: Lagos State Government should invest in smart traffic management technologies that utilise real-time data analytics to optimise traffic flow and minimise congestion, which can indirectly reduce accident rates.
3. **Sustainable Urban Planning and Infrastructure Development**: Focus on urban planning that accommodates the growing urban population while ensuring safe transportation infrastructure. This includes designing wider roads and dedicated pedestrian lanes to promote safer travel options.
4. **Public Transport Improvements**: The government should make more improvements in the existing public transportation services by introducing new routes, which will enhance public transportation systems to reduce the reliance on personal vehicles, thereby decreasing the number of registered vehicles on the roads. This can involve investing in reliable and efficient bus and rail services.
5. **Community Awareness and Education**: **The government and its stakeholders should** launch public awareness campaigns aimed at educating drivers about safe driving practices, the importance of adhering to traffic laws, and the dangers of speeding.
6. **Regular Data Collection and Analysis**: **There should be regular** studies to continuously monitor the relationship between urbanization factors and traffic accidents. This will help identify emerging trends and evaluate the effectiveness of implemented safety measures. Develop an integrated database that collects and analyses traffic accident data, urban population statistics, and vehicle registration figures to inform future policy decisions.
7. **Policy Development and Implementation**: Review and strengthen existing traffic regulations to address the challenges posed by increasing urbanization and vehicle registration. This includes stricter penalties for traffic violations and promoting compliance with safety standards.

8. **Collaboration with Stakeholders**: Foster collaboration between government agencies, private sector stakeholders, and non-governmental organisations to implement comprehensive road safety strategies that address the multifaceted nature of traffic accidents.

5.3 Conclusion

Urbanization is an inevitable driver of economic and social development; it also poses a significant risk to road safety if left unmanaged. Thisstudy provides valuable insights into the dynamics of urbanization and its impact on road traffic accidents in Lagos. While urban population and registered vehicles are positively correlated with accident rates, a decreasing trend associated with population growth highlights potential improvements in traffic management. Overall, the model shows a significant relationship between urbanization factors and traffic accidents. By implementing these recommendations, Lagos can enhance its road safety measures, improve traffic management, and ultimately reduce the incidence of road traffic accidents amidst ongoing urbanization.

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