Inflation Volatility and Road Accidents: A Panel Analysis for Nigeria

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Abstract
This study investigates the effect of inflation volatility on road traffic accidents across States in Nigeria, using a panel dataset spanning 2017 to 2020. Descriptive and inferential statistics were employed to analyse the data used in this study. Inflation volatility is computed using the rolling standard deviation method, while road traffic crashes were obtained from the National Bureau of Statistics. The random-effects estimator and Hausman-Taylor instrumental variable approach were employed to analyse panel data of 36 states and the Federal Capital Territory, Abuja. The study reveals that inflation volatility negatively affects road transport crashes across Nigerian states and reduces the number of reported cases in the North East and North Central regions. We also discovered that unemployment has a significant and positive impact on road transport crashes across states in all geopolitical zones in Nigeria. Further findings reveal that drug abuse significantly increases road transport crashes in the South-South region. Still, it does not significantly determine road transport crashes in other regions of the country. This study therefore concludes that aside from unemployment, inflation volatility should not be ignored when discussing road transport crashes in Nigeria. It is therefore recommended that there be better coordination between macroeconomic policy and road safety management in Nigeria.

Keywords: Inflation, Inflation Volatility, Nigeria, Road Accidents, Road Transport
JEL Codes: C23, E31, O55, R41

1. Introduction

Macroeconomic stability is still a top goal for any economy. But it continues to pose a real challenge for many developing countries, including Nigeria (Mankiw, 2021; Blanchard, 2017). Inflation is one of Nigeria's toughest, most stubborn macroeconomic issues. It reduces the currency's purchasing power. It also breeds uncertainty for households, businesses, and government. And when inflation turns erratic and unpredictable, the problems just get worse, leading to what is commonly referred to as inflation volatility (Friedman, 1977; Engle, 1982). Lately, scholars have turned more attention to the social and welfare effects of inflation volatility. It has gone beyond the usual impacts on investment, growth, and exchange rates. Research has linked inflation volatility to education (Bhattacharjee, 2017), public health (Movsisyan et al., 2024), crime (Rosenfeld, 2014), and overall well-being (Simeon et al., 2025). They conclude that inflation volatility leads to hardship in our everyday life.

This study proposes that inflation volatility can influence road traffic accidents in two ways. On the one hand, price fluctuations erode real incomes and increase financial pressure on households. This leads households to ignore vehicle maintenance, delay repairs, or drive unsafe cars. Thereby

endangering households' movements. Similarly, inflation uncertainty hikes costs for fuel, spare parts, and transportation services. It also tempts commercial drivers to overload vehicles or work longer hours for extra income, thus increasing fatigue and the risk of accidents. Furthermore, an unstable economy may affect public expenditures on road maintenance, reduce compliance with traffic laws, and accelerate infrastructure deterioration, thereby increasing the risk of road accidents (World Bank, 2020). On the other hand, inflation volatility may also reduce the level of road accidents. For instance, inflation volatility increases the cost of maintaining vehicles. Due to rising maintenance costs, many firms and households may prefer commercial vehicles to personal cars. This action reduces road traffic, thereby allowing free and safe movement of fewer vehicles on highways.

Despite the connection between economic conditions and road crashes, only a few studies have empirically examined the consequences of macroeconomic factors on road traffic accidents in developing countries (Akinyemi, 2020; Yakubu et al., 2021). Most specifically, the effect of inflation volatility on road transport accidents has not been examined. In addition, no known study has examined the linkages using state or province-level data. This paper addresses the gaps and constitutes the study's novel contributions. It examines the effect of inflation volatility on road crashes in Nigeria. Road traffic accidents are a threat to public safety and constitute a developmental challenge in Nigeria. They cause loss of life, injuries, property damage, and have reduced the economic productivity of households and firms (Ajide, 2020). Inflation volatility is employed as the principal variable of interest because it captures uncertainty rather than the burden of cost. It affects how household and commercial operators plan their trips and budget for fuel and vehicle maintenance. This study investigates whether fluctuations and uncertainty in inflation contribute to road traffic accident outcomes in Nigeria.

2. Literature Review

2.1 Conceptual Review

2.1.1 Inflation

Inflation is broadly understood as an uninterrupted, sustained increase in the general price level of goods and services over time, which reduces the purchasing power of money. There are several schools of thought on the subject. Economists agree that inflation is a steady, ongoing increase in commodity prices over time. The term inflation was defined by Balami (2006) as a long-term, widespread increase in the cost of goods and services. Inflation is also defined as a sustained increase in the general price level of goods and services over time, which reduces the purchasing

power of money (Mankiw, 2021). From a measurement perspective, inflation can be captured using indices such as the consumer price index (CPI) or the GDP deflator, with both tracking changes in the cost of living and in aggregate production across the economy.

In Nigeria, the causes of inflation are multidimensional, spanning monetary, fiscal and structural factors. Inflation is a persistent macroeconomic challenge that affects household consumption patterns, investment decisions, and government fiscal operations.

2.1.2 Inflation Volatility

While inflation operates through a cost-of-living or purchasing-power mechanism, inflation volatility operates as an uncertainty mechanism. Inflation volatility can be defined as the degree of instability, unpredictability or fluctuations in the rate of inflation over time. Unlike inflation, which measures how fast prices are rising, inflation volatility captures how uncertain that rate of increase is from one period to the next. Statistically, Inflation Volatility is commonly measured as the variance or standard deviation of inflation relative to its mean (Kiguel & Liviatan, 2018). Studies suggest that the adverse effects of inflation on economic performance are largely driven by inflation volatility rather than inflation levels alone (Friedman, 1977; Judson & Orphanides, 1996). High inflation volatility increases uncertainty, disrupts government planning for the future, and hampers resource allocation. In 2016, high levels of uncertainty were observed in Nigeria, coinciding with an economic recession caused by a global oil crash, foreign exchange restrictions, and inflationary pressures, with further spikes due to the government's fiscal and monetary responses. A sharp spike in uncertainty also occurred in the first quarter of 2020, coinciding with the COVID-19 period, which led to exchange-rate pressures, supply chain disruptions, and external shocks. Inflation volatility is a concern because unpredictability distorts economic planning and undermines the ability of households, government, and firms to function effectively in the economy. Among emerging market economies, Nigeria exhibits the highest inflation and exchange rate variability (Onyukwu et al., 2011). The macroeconomic implications of inflation volatility in the Nigerian economy are profound. Spiking uncertainty, weak purchasing power, and inefficient capital allocation are outcomes when inflation exceeds critical thresholds, supporting the endogenous growth model, in which macroeconomic stability serves as a prerequisite for sustained capital accumulation and technological advancement (Onwubuariri, 2021).

2.1.3 Concept of Road Traffic Accidents

A road traffic accident is broadly defined as an unplanned, sudden event involving one or more vehicles on a public road that results in injury, death, or property damage (World Health Organisation, 2023). It can also be defined as an accident (usually a collision of a vehicle with another vehicle, animal, road debris, or other stationary obstruction) that occurs on a road, way or street open to public transport. Road traffic accidents are the major cause of fatal and minor injuries leading to disabilities and other indirect health consequences (Anebonam et al., 2019).

Road traffic accidents in Nigeria are among the most severe in the world. From October 2017 to March 2018, which approximates six months, about 2600 deaths were caused by road accidents, and approximately 20000 vehicles are involved in road traffic accidents every day in Nigeria, leading to a loss of more than 27 lives, equivalent to more than 4 families in a day (Eneh et al., 2023). According to the Federal Road Safety Corps (FRSC), in 2015 Nigeria recorded 12,077 road accidents, with an estimated 5,400 fatalities. National Bureau of Statistics reported that in 2016, 11363 road traffic accidents were recorded with 5063 deaths, and in 2017, NBS reported 10026 cases of road crashes and 5049 deaths. In 2021, the highest number of road crashes was recorded with 10637 accidents involving 35791 people; 501 people died, while 30690 were injured (Alafa & Etim, 2023). The Federal Road Safety Corps (FRSC, 2022) identifies the major causes of road accidents in Nigeria as over-speeding, reckless driving, poor road conditions, and mechanical failure. Globally, road traffic accidents are among the leading causes of death, accounting for approximately 1.19 million deaths annually (WHO, 2023). In Nigeria, where road transport accounts for over 90% of passenger and freight movement (NBS, 2023), the implications of road accidents are particularly severe.

2.1.4 Inflation Volatility and Road Accidents: Transmission Channels

Although inflation, inflation volatility, and road traffic accidents may appear unrelated at first glance, several transmission channels link macroeconomic instability to road safety outcomes. One major channel operates through the cost of vehicle maintenance and operation. Inflation volatility increases and destabilises the prices of essential automobile inputs such as fuel, tyres, engine oil, and spare parts. When these costs become unpredictable or persistently high, vehicle owners and commercial drivers may delay routine maintenance, use substandard replacement parts, or continue operating vehicles that are no longer roadworthy. Over time, such cost-saving adjustments significantly increase the likelihood of mechanical failure, brake malfunction, Tyre bursts, and other vehicle-related accidents on Nigerian roads. Another important channel is the income-and-

financial-stress mechanism. Inflation volatility reduces purchasing power and creates uncertainty about future earnings, particularly for households and individuals whose incomes do not adjust in proportion to rising prices (World Bank, 2018). For commercial drivers and transport operators, this financial pressure can translate into longer working hours, reduced rest periods, and increased fatigue as they attempt to meet daily income targets (Kitara & Karlsson, 2020). Fatigue and stress are well-documented risk factors for impaired judgment, slower reaction time, and reduced concentration while driving, all of which increase the probability of road traffic accidents (RoSPA, 2024).

In addition, inflation volatility may influence driving behaviour and risk-taking decisions. In periods of economic pressure, drivers may engage in aggressive driving practices such as speeding, overloading passengers or goods, and disregarding traffic regulations to maximise earnings per trip. These behaviours are often motivated by the need to offset rising operational costs and declining real income. Such risk-taking tendencies significantly heighten exposure to road crashes, particularly in high-traffic and poorly regulated transport environments. Macroeconomic instability may also indirectly affect public sector capacity and road safety enforcement. Persistent inflationary pressures can constrain government budgets in real terms, thereby limiting adequate investment in road maintenance, traffic management systems, and enforcement agencies. Weak enforcement of traffic laws and deteriorating road infrastructure further amplify the risk of accidents.

Overall, these interconnected channels demonstrate that inflation volatility not only operates as an economic phenomenon but also translates into behavioural, mechanical, and institutional conditions that increase exposure to road traffic accidents.

2.2 Theoretical Review

This study depends on a comprehensive theoretical framework that combines the Permanent Income Hypothesis, Risk Compensation Theory, and Economic Stress Theory to measure the impact of inflation volatility on road transport accidents in Nigeria.

2.2.1 Permanent Income Hypothesis

The Permanent Income Hypothesis (Friedman, 1957) posits that individuals base consumption decisions on expected long-term income rather than current income.

This theory posits that consumption patterns are based on future expectations and consumption smoothing. Income is divided into a permanent (anticipated and planned) component and a

transitory (unexpected and surprising) component. Inflation volatility distorts income expectations and consumption planning, potentially affecting transport usage patterns and safety decisions. This theory provides a behavioural foundation for understanding how inflation and inflation volatility affect household and individual consumption and investment decisions in Nigeria, with downstream consequences for road traffic accident risk. Inflation volatility distorts income expectations and consumption planning, potentially affecting transport usage patterns and safety decisions.

2.2.2 Risk Compensation Theory

Risk Compensation Theory, also known as Risk Homeostasis, is one of the leading behavioural frameworks in road safety research. Wilde (1982) suggests that individuals adjust their behaviour in response to perceived risk. This means people adjust their behaviour when they feel more or less safe. In simple terms, when there is a guarantee of safety, people take more risks, but when people feel insecure, they tend to act more carefully. Wilde (1982) also proposed that the accident rate is ultimately dependent on a single factor: the target level of risk in the population concerned, which serves as the reference variable in a homeostasis process linking accident rate to human motivation. When inflation is highly volatile, economic pressure may encourage drivers to take greater risks, in an attempt to offset rising costs. Under this condition, drivers, who constitute a large share of road users, face immense economic pressure to take on more trips, drive faster, and use poorly maintained vehicles to maximise daily earnings. When this happens, the rate of crashes will increase, and it will be very difficult to control because the cause is an adjustment in drivers' behavioural control. This theory may provide a powerful lens for understanding the high rate of road traffic crashes despite repeated, multiple government interventions.

2.2.3 Economic Stress Theory

Economic Stress Theory states that financial problems or hardship, income insecurity, and economic deprivation generate psychological and behavioural imbalances that hamper decision-making, reduce cognitive attention, and increase the likelihood of recklessness. Agnew (1992) emphasises that financial strain influences behaviour and decision-making. Financially stressed commercial drivers in Nigeria are driven to overload vehicles, neglect maintenance, work longer hours without rest, and disregard traffic laws to generate enough income to offset their mounting financial burden. Furthermore, inflation volatility intensifies economic stress by creating uncertainty around future finances. When this happens, households and businesses can no longer plan effectively, causing chronic anxiety that impairs concentration and increases impulsivity, which is very dangerous, particularly among drivers. Economic stress indirectly reduces vehicle

quality and road-use patterns. With only a few able to afford quality vehicles, individuals affected by economic stress will have to settle for a second-hand vehicle. Poor vehicle and road quality together constitute direct factors in road crashes in Nigeria (Eneh et al., 2023). Inflation volatility increases economic stress, which can impair concentration, judgment, and emotional regulation while driving, thereby increasing the risk of accidents.

The three theories provide a solid ground for this study. The permanent income hypothesis explains why inflation volatility, rather than the inflation level, disrupts expected income. Economic Stress Theory accounts for the resulting behavioural pressure, while Risk Compensation Theory clarifies why this pressure leads to reduced risk-taking instead of increased recklessness. Collectively, these theories predict the negative relationship between volatility and crashes that the empirical model examines.

2.3 Empirical Literature

Road transport accidents are not caused by a single factor. Ajide (2020) linked criminal activities to road accidents in Nigeria's transport industry, employing the Autoregressive Distributed Lag (ARDL) technique to establish that socio-economic conditions contribute to unsafe transport behaviour. Some studies have empirically investigated the direct link between macroeconomic volatility and road transport accidents. A review of the literature reveals that many empirical studies in this field are from developed economies and employ various estimation methods to examine how economic conditions affect road safety outcomes. For instance, Rhum (2020) established one of the most foundational empirical results in this literature.

Rhum (2020) found that, all else equal, a 1% increase in unemployment will significantly increase motor vehicle fatalities by approximately 3% in the United States. This means that fatalities rise during periods of economic growth and fall during economic downturns.

Law (2015) used a fixed-effects negative binomial regression analysis on panel data from 90 countries for the period 1963-2009 to study the Kuznets-curve relationship between non-fatal road injuries and per capita income. These findings revealed that the frequency of road deaths increased as per capita income fell. He et al. (2015) conducted another study using multivariate fixed-effects estimates from 2004 to 2011 to investigate the relationship between gross regional product, road

traffic fatalities, and the crash fatality ratio across 66 regions in Russia. He et al. found that road traffic fatalities and crash fatality ratios declined as gross regional product per capita increased.

Rapeepong Suphanchaimat et al. (2019) used Negative Binomial regression, Negative Binomial with random effects and a spatial Durbin model to examine economic development and road traffic injuries and fatalities across Thai provinces from 2012 to 2016. According to the findings, both road traffic injuries and traffic deaths were positively correlated with provincial GDP. The result shows that a percentage increase in GDP per capita increases the incidence of injuries and deaths by approximately 23.8 to 30 per cent. Akinyemi (2020) conducted a comprehensive sub-national empirical examination using the ARDL methodology to assess cointegration from 1991 to 2016 and to examine the relationship between economic development (proxied by GDP per capita and the unemployment rate) and road traffic crashes, fatalities, and injuries in Nigeria. The results showed that both crashes and fatalities decrease while injuries increase with GDP growth, and that GDP has a significant long-run effect on crashes, fatalities, and injuries, though only a short-term impact on mortality and injuries.

A research study titled a comparative analysis of road and vehicle qualities as factors of road traffic carnage in Nigeria by Eneh et al. (2023), employing multiple linear regression to jointly assess road quality and vehicle quality as determinants of road traffic death tolls, showed that for every decrease in road quality, death tolls from road traffic crashes in Nigeria significantly increased. For every decrease in vehicle quality, death tolls increased, directly linking inflation-induced purchasing power erosion, which forces Nigerians into poor-quality second-hand vehicles, to road accident mortality.

In a study by Yakubu et al. (2021), a dynamic system generalised method of moments (GMM) technique was employed to examine the impact of economic conditions, proxied by unemployment, on road crashes. Investigations in this research showed that unemployment has a positive impact on all geopolitical zones in Nigeria. In this study, inflation was also found to be a threat to road safety outcomes in Nigeria, especially in the South East, South-South, and North East. The study also showed that causative factors such as speed limit violations, poor road conditions, and obstruction violations increase the risk of road crashes. Yakubu et al. (2023) employed an autoregressive distributed lag model to analyse data on income inequality and road transport accidents in Nigeria. This study showed that income inequality has a significant positive impact on road crashes in both the long and short run.

Despite these findings, empirical studies directly examining the relationship between inflation volatility and road accidents remain scarce, particularly at the sub-national level. This study therefore fills this gap in the literature by providing evidence on the impact of inflation volatility

on Road transport accidents at the sub-national level from 2017-2020, employing a panel framework with random effects and the Hausman-Taylor estimator.

2.3.1 Inflation, Inflation Volatility and Road Traffic Accidents

Inflation is a persistent macroeconomic phenomenon characterised by a sustained increase in the general price level of goods and services over time. It affects the purchasing power of money and influences the consumption and production decisions of households, firms, and the government. In developing economies such as Nigeria, inflation is often driven by structural constraints, exchange rate fluctuations, and supply-side bottlenecks, making it difficult to stabilise (Mankiw, 2021).
Inflation volatility, on the other hand, refers to the degree of unpredictability or fluctuation in the inflation rate over time. Unlike steady inflation, volatile inflation creates uncertainty in economic planning and decision-making for both individuals and institutions.

According to Engle (1982), volatility reflects time-varying uncertainty in economic variables, and in the case of inflation, it affects expectations, income stability, and consumption behaviour. The linkage between inflation, inflation volatility, and road traffic accidents can be understood through several transmission mechanisms. Inflation and its volatility affect the cost of transportation inputs such as fuel, vehicle parts, and maintenance services. When these costs rise unpredictably, vehicle owners and commercial drivers may reduce spending on proper maintenance, delay repairs, or resort to the use of substandard spare parts. Such decisions increase the likelihood of mechanical faults, which are significant contributors to road traffic accidents (World Bank, 2020). Furthermore, inflation volatility influences real income and labour conditions, particularly among transport operators and commercial drivers. As the real value of earnings declines due to rising prices, drivers may be compelled to work longer hours or take more daily trips to maintain their income. This often results in fatigue, stress, and reduced concentration, all of which are key human factors associated with road crashes.

Another channel is that inflationary pressures may lead to risk-taking behaviour among drivers, including speeding, overloading passengers or goods, and ignoring traffic regulations. These behaviours are often motivated by the need to maximise income under adverse economic conditions. Such risky driving practices significantly increase the risk of road traffic accidents. Finally, inflation volatility may indirectly affect public investment in road safety and infrastructure. When inflation is high and unstable, the real value of government budgets is eroded, potentially limiting adequate funding for road maintenance, traffic enforcement, and safety campaigns. Poor

road conditions and weak enforcement systems further increase the risk of accidents. Overall, the interaction between inflation, inflation volatility, and road traffic accidents operates through economic, behavioural, mechanical, and institutional channels. These interconnected pathways suggest that macroeconomic instability may have important implications not only for economic performance but also for public safety outcomes such as road traffic accidents.

2.3.2 Other Macroeconomic Conditions and Road Traffic Accidents

Beyond inflation and inflation volatility, other macroeconomic conditions also play an important role in shaping road traffic accident outcomes. Macroeconomic indicators such as unemployment, income levels, government revenue, and overall economic growth influence individual behaviour, transport demand, infrastructure quality, and government capacity to enforce road safety regulations (World Bank, 2020; Blanchard, 2017).

Unemployment has been identified as a key macroeconomic factor that may indirectly affect road traffic accidents. High unemployment increases economic pressure on individuals, particularly those engaged in commercial transportation. In an attempt to sustain income, drivers may work longer hours, experience fatigue, speed, and overload, thereby increasing the risk of accidents (ILO, 2021). Government revenue also plays a significant role in road safety outcomes. Higher revenue improves government capacity to invest in road infrastructure, traffic management systems, and enforcement agencies. Conversely, fiscal constraints may lead to poor road maintenance and weak enforcement of traffic laws, both of which contribute to higher accident rates (World Bank, 2020). Economic growth influences road traffic accidents through increased mobility and vehicle usage. While growth may improve infrastructure in the long run, in developing economies like Nigeria, rapid expansion without adequate investment in safety may lead to congestion and increased accident exposure (WHO, 2018). Overall, macroeconomic conditions interact through behavioural

responses, infrastructural development, and institutional effectiveness to influence road traffic accident outcomes.

3 Methodology

3.1 Model Specification

This study specifies its empirical model here, following existing studies (Yakubu et al., 2021; Ajide, 2020; Akinyemi, 2020), and includes the key variable of interest. The empirical model is as follows:

$$lnRTC_{it} = \varphi_0 + \varphi_1 ln\ \text{VOL}_{it} + \varphi_2 ln\text{DRUG}_{it} + \varphi_3 UNE_{it} + \varphi_4 ln\text{IGR}_{it} + \epsilon_{it}$$

Where: $lnRTCit$ is the log of Road Transport crashes in state i in year t; $ln\text{VOL}_{it}$ is Inflation volatility. Inflation volatility captures uncertainty rather than the cost burden, so it is employed to show the research's theoretical positioning that road traffic accidents, as a behavioural outcome, are more plausibly driven by the unpredictability of price changes than by their magnitude alone. $ln\text{DRUG}it$ is the percentage of drug abuse in state i at period t; UNE_{it} is unemployment in state i at period t; IGR_{it} is the log of internally generated revenue in state i at year t; ϵit is the term that accounts for the unobserved factors that affect road accidents. Coefficient_1 captures the direct impact of inflation volatility on road transport accidents. This shows how changes in inflation levels (inflation volatility) affect road transport crashes. Coefficient φ_2 shows the direct impact of drug use on road transport crashes. A high percentage of drug abuse is expected to have an effect on road transport accidents since drug abuse causes so much damage to the brain and other parts of the body, which can directly influence the movement of drivers on the road. Coefficient φ_3 indicates how unemployment affects the number of crashes on the road. To be a stable driver, a stable mind and a few years of experience are required. If the unemployment rate keeps rising, people may turn to transportation even if they don't have the experience or stability required to drive. Coefficient φ_0 shows the level of road crashes if all other variables are constant. Unemployment can also influence road transport accidents.

In a study by Yakubu and Muhammed (2021), a positive relationship was found between road transport crashes and unemployment. A high unemployment rate usually causes more road transport crashes by increasing the number of road users who set out every day to make ends meet, thereby increasing road usage and accidents. Coefficient φ_4 shows the direct effect of internally generated revenue on the number of road transport crashes. IGR does not directly cause road accidents; it indirectly affects road transport crashes through infrastructure quality, enforcement, and governance.

3.2 Estimation Technique:

The method used to estimate the impact of inflation volatility on road accidents is detailed in this section. This study employs panel data methods to assess the impact of inflation volatility on road accidents across the 36 states and the Federal Capital Territory (Abuja) from 2017 to 2020. Estimations are performed in two steps. To begin with, the volatility measure is the standard deviation of annual inflation across the 4-year sample period (one value per state for each of the 4 years, which is time-invariant). Also, inflation volatility is measured using the rolling standard deviation method. It measures the rate of inflation fluctuation over time and thus estimates the uncertainty associated with inflation.

The rolling standard deviation is appropriate for this study because it captures the time-varying variation in inflation and provides a time-varying measure of inflation volatility (Tsay, 2010). The formula used is stated below:

$$\sqrt{\frac{1}{n-1}\sum_{t-1}^{n}(\pi_{i,t} - \lambda_i)^2}$$

Where $\pi_{i,t}$ is the annual inflation for state i in year t, λ_i is the mean annual inflation rate for the state over the sample period, and n=4n. This produces a single, time-invariant measure of inflation unpredictability per state, reflecting the overall degree of price uncertainty experienced across the sample window.

The GARCH models are not used because they require a long time series to estimate conditional volatility. For the 48 monthly observations (4 years), GARCH models are not econometrically feasible for this state-level data. In the second stage, the Breusch-Pagan Lagrangian multiplier test was conducted to determine which technique is appropriate, pooled OLS or random-effects estimation. Given that the Breusch-Pagan LM test results supported the random-effects estimation technique, it was used to examine the relationship between inflation volatility and road accidents. Given that inflation volatility is time-invariant within each state over the sample period, the Random Effects estimation is preferred to Fixed Effects estimation because Fixed Effects cannot estimate the coefficient on a regressor with no within-group variation. The Random Effects model is further supported by the results of the Hausman specification test in this study. Random effects represent variation across panel units. This means the effects on individuals are uncorrelated with the model's explanatory variables. This allows for both cross-sectional and time-series variation in the data.

To further enhance the reliability of estimates, the Hausman-Taylor estimator is used to account for potential endogeneity in some explanatory variables and to account for time-invariant variables. Unemployment and inflation volatility are treated as the endogenous time-varying regressors, because macroeconomic conditions and road-accident-related economic disruption can be jointly determined. The remaining time-varying regressors are used as internal instruments for the exogenous variables. This approach is based on internal measures of exogenous variables and provides more robust and consistent estimates. For example, macroeconomic shocks such as fuel price fluctuations, monetary instability and broader economic uncertainty may simultaneously influence inflation volatility and road transport crash occurrences across states. To account for this endogeneity, the Hausman-Taylor estimator was employed, using internal instruments derived from the model's exogenous variables to obtain consistent parameter estimates. The combination of rolling standard deviation, Random Effects estimation, and Hausman-Taylor estimation provides an appropriate framework for studying the impact of inflation volatility and road accidents by accounting for unit-level heterogeneity and correcting for potential endogeneity.

3.3 Nature, Source of Data, and Variable Description

The focus of this study is primarily on the impact of inflation volatility on road accidents across Nigeria's states. There are 36 states in Nigeria, plus the Federal Capital Territory (FCT), for a total of 37. The Sample covers the 36 states and FCT (Abuja). The data for road transport crashes, unemployment, inflation, drugs, and *IGR* were sourced from the National Bureau of Statistics (NBS). The brief description of the variable, along with its source, is presented in Table 1.

Table1: Data Sources

VARIABLES	DESCRIPTION	SOURCE OF DATA
Road transport crashes (*ln*RTC)	Natural log of reported road transport crash cases. This is incident-based administrative reporting. Crashes are recorded at the point of occurrence by the road safety personnel, then aggregated and published. Here in this study, the number of traffic crashes is measured.	National Bureau of Statistics (NBS)
Inflation Volatility *(ln*VOL)	Measured using the rolling standard deviation method on annual growth of the consumer price index.	Generated by the author, but the annual data on inflation, proxied by the consumer price index, is sourced from the National Bureau of Statistics (NBS)
Drug Abusers (*ln*DRUG)	This is the natural log of drug abusers. This is the percentage of drug users in each state.	National Bureau Of Statistics(NBS)

Unemployment (UNE)	Annual percentage of unemployed individuals to the total labour force.	National Bureau of Statistics (NBS)

Source: Authors' computation, 2026

4 Empirical Results and Discussion

4.1 Descriptive statistics and correlation coefficients

In the preliminary results, Table 2 shows the descriptive statistics. It describes the variables in terms of the mean, standard deviation, and minimum and maximum values. The analysis reveals that the average number of road transport crashes is 177.4 cases across the country (Nigeria) during the study period. With a standard deviation (spread) of 172.48 crashes around this average, a state witnessed as few as 7 cases in a particular year and as many as 1811 in another. This means that there is considerable variation in the occurrence of road transport crashes across the states over time.

This can result from differences in traffic conditions, Road transport infrastructure, and the enforcement of traffic laws. Inflation averaged 13.02 per cent across Nigeria's states during the study period, with a spread of 2.12 per cent around this average. A minimum of 8.21 per cent inflation was recorded by a state in a given year, and as high as 21.92 per cent was recorded in another year. This indicates that variations in inflation across states stem from differences in economic conditions and price stability. The Natural log of internally generated revenue (IGR) has an average of 23.47 per cent, with a spread of 0.98 per cent around this average. The minimum value of internally generated revenue is 22 per cent generated by a state in a particular year, and the maximum value of internally generated revenue is 26.67 per cent generated by a state in a particular year. This implies that IGR differed across states, even though the variation was relatively moderate, due to disparities in internal revenue-generating capacity. Drug abuse averaged 14.18 per cent with a spread of 4.69 per cent around this average. As low as 7 per cent of drug abuse cases were witnessed by a state in a given year, and as high as 33 per cent of drug abuse cases were witnessed by a state in a given year.

This indicates the prevalence of drug abuse varied across states and years, suggesting exposure to substance abuse and social conditions. Unemployment across the states averaged 15.77 per cent, with a spread of 10.98 per cent around this average value. A minimum of 0.12 per cent and a maximum of 36.51 per cent unemployment were recorded by a state in a given year. This can be due to uneven economic opportunities and labour market conditions.

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Crashes(RTC)	148	177.405	172.488	7	1181
Inflation	148	13.026	2.119	8.21	21.92
Natural log of IGR	148	23.465	0.977	22.004	26.669
Drug abuse	148	14.184	4.688	7	33
Unemployment	148	15.77	10.976	.117	36.51

Source: Authors' computation, 2026

To further describe the variables in this study, we also conducted a pairwise correlation analysis. This was done to investigate the linear relationship that exists between the variables and to check for possible multicollinearity. The results show the correlation coefficient between each pair of variables and indicate whether the relationships are statistically significant. The result shows that road transport crashes have a positive significant relationship with IGR, and have no significant relationship with inflation volatility, drug abuse and unemployment. This means that states with higher internally generated revenue tend to record more road transport crashes and vice versa, possibly due to higher levels of economic activities and road usage.

The results also showed that inflation volatility has a significant positive relationship with the unemployment rate, suggesting that both inflation volatility and the unemployment rate move in the same direction. This indicates that an increase in inflation volatility will significantly raise the unemployment rate. Inflation volatility is seen to have an insignificant relationship with IGR and drug abuse. Likewise, it is also shown in the results that Drug abuse has a positive significant relationship with internally generated revenue. This indicates that states with higher internally generated revenue also tend to record higher levels of drug abuse. Drug abuse has no significant relationship with unemployment. The results also show no significant relationship between IGR and unemployment. The results also show no significant relationship between IGR and unemployment.

Table 3: Pairwise correlation

Variables	Incrashes	Inflv	INDRUG	InIGR	UNE
(1) lnRTC	1.000				
(2) *ln*VOL	0.135	1.000			
	(0.157)				
(3) *ln*DRUG	0.076	0.058	1.000		
	(0.360)	(0.547)			
(4) *ln*IGR	0.295*	-0.011	0.441*	1.000	
	(0.000)	(0.905)	(0.000)		
(5) UNE	0.088	0.521*	-0.023	0.045	1.000
	(0.289)	(0.000)	(0.783)	(0.590)	

** p<0.1*

Source: Authors' computation, 2026

Table 4 presents the variance inflation factors to assess multicollinearity among the explanatory variables. The results show that VIF values for all regressors are below 5, indicating no evidence of multicollinearity. The explanatory variables are not linearly related, which means they can be included in the regression model without causing estimation problems.

Table 4: Variance inflation factor

	VIF	1/VIF
*Ln*VOL	1.383	.723
UNE	1.377	.726
*Ln*DRUG	1.268	.788
*Ln*IGR	1.264	.791
Mean VIF	1.323	.

Source: Authors' computation, 2026

In Table 5, the Breusch-Pagan Lagrangian Multiplier test and Hausman specification test were conducted to determine the appropriate panel estimator. The Breusch-Pagan test results (statistic = 68.07, p-value=0.000) confirm the presence of significant state-level heterogeneity, ruling out Pooled OLS. To this end, a Hausman specification test was also conducted to justify the use of the random-effects estimator for this study. The result shows that the chi-square statistic is 3.12 with a p-value of 0.2098, which is greater than the 5% significance level. This result indicates insufficient evidence to reject the null hypothesis that the difference in coefficients is not systematic. Therefore, the random-effects model is more appropriate for this study because individual-specific effects are

uncorrelated with this variable. Consequently, the random-effects model is preferred due to its efficiency and consistency.

Table5: Breusch-Pagan and Hausman specification tests

Diagnostic Test	Statistic	p-value
Breusch-Pagan LM Test (Var(u) = 0)	68.07	0.0000
Hausman Specification Test	3.124	0.2100

Source: Authors' computation, 2026

4.2 Regression Results

Table 6 presents the Pooled Ordinary Least Squares (OLS), random-effects, and Hausman-Taylor estimation results. The Wald chi-square probabilities (0.000) for both random-effects and Hausman-Taylor are significant at the 1% level. This indicates that the explanatory variables are jointly significant in explaining variations in road transport crashes. Under pooled OLS, which does not account for state-level heterogeneity, inflation volatility is statistically insignificant. However, when the panel effects are explicitly modelled, the results change: inflation volatility becomes statistically significant in the random-effects and Hausman-Taylor results. The random-effects estimate for inflation volatility indicates that, across states and over time, a 1-unit increase in inflation volatility is associated with a 6.2% decrease in road transport crashes, holding other variables constant. This means that higher inflation volatility is associated with higher transportation and vehicle operating costs, thereby reducing road usage and consequently lowering the frequency of road crashes. The negative relationship could also indicate that the sample period (2017-2020) overlaps with the onset of the COVID-19 pandemic, during which lockdown measures independently suppressed road usage nationwide (Okeke et al., 2023). Also, fuel shortages, which have historically coincided with periods of macroeconomic instability in Nigeria, could reduce vehicle usage through a supply-side channel (Nnabuife et al., 2016).

The result also shows that, in the random-effects estimation, across states and over time, a 1% increase in the unemployment rate leads to a 0.033% increase in road crashes, holding other variables constant. This means that unemployment is a key factor in rising road transport crashes across states. This aligns with the findings of Yakubu and Muhammed (2021) and Akinyemi (2020) that movements in unemployment strongly determine the level of road transport accidents. Their results also show that internally generated revenue and drug abuse insignificantly affect road transport crashes. In the Hausman-Taylor results shown in Table 6, inflation volatility was treated

as an endogenous variable because it may be correlated with unobserved macroeconomic factors that also affect road transport crashes. The inflation volatility coefficient (-0.065) is negative and statistically significant, indicating that, holding other variables constant, a 1-unit increase in inflation volatility reduces road crashes by 6.5%. The significance of this coefficient after controlling for endogeneity signals that inflation volatility has a robust effect on road transport.

Unemployment has a positive and significant relationship with road transport crashes, indicating that a worsening labour market can increase the number of road transport crashes, as found by Yakubu and Mohammed (2021). Drug abuse and internally generated revenue have statistically insignificant relationships with road transport crashes across the state during the study period.

Table 6: Pooled OLS, Random-effect and Hausman-Taylor

InRTC	Pooled ols	RE.	Hausman Taylor
Inflv	0.017 (0.69)	-0.062** (0.02)	-0.065*** (0.00)
InDRUG	-0.057 (0.79)	-0.002 (0.95)	-0.002 (0.96)
LnIGR	0.242*** (0.00)	0.228 (0.12)	0.228 (0.15)
UNE	0.014* (0.08)	0.033*** (0.00)	0.033*** (0.00)
Constant	-0.819 (0.69)	-0.694 (0.83)	-0.687 (0.845)
Group	37	37	37
Wald Chi-square	–-	107.33*** (0.000)	118.68*** (0.000)
R^2	0.1151	0.0916	

Note that: (***), and (**) imply statistically significant at 1%, and 5%, respectively

Source: Authors' computation, 2026

After all the results, it is clear that the important role of inflation volatility in causing road transport crashes in all states in Nigeria cannot be ignored. It is significant to conduct this analysis across states in each geopolitical zone in Nigeria. Table 7 shows the random-effects results for the Geopolitical zones. Inflation volatility is significant only in its effect on road transport crashes in two geopolitical zones: North East (NE) and North Central (NC). Inflation volatility negatively affects road transport crashes only in these two regions, indicating that an increase in inflation volatility will reduce road transport crashes there. Drug abuse has a significant relationship with

road transport crashes only in the South-South (SS) region. Unemployment remained significant and had a positive effect on road transport crashes across all geopolitical zones except the south-western (SW) region. The insignificance of inflation volatility, drug abuse, IGR, and unemployment under the random-effects estimator may be attributed to the region's unique economic structure and to the presence of unobserved regional characteristics correlated with labour market conditions.

The Hausman-Taylor estimator test was also conducted to address endogeneity between the independent variable and unobserved regional effects. The results in Table 8 show the Hausman-Taylor estimates of the geopolitical zones in Nigeria. Unemployment significantly increases road transport crashes in all the geopolitical zones in Nigeria, including the southwest region. This means that the Hausman-Taylor estimation accounted for the unobserved regional effect on the relationship between unemployment and road transport crashes in the South-West region. Inflation volatility significantly reduces road crash levels in three regions: North East, North Central, and South West. This reveals that the negative effect of inflation volatility on road crashes in the South West was obscured in the random-effects result due to endogeneity. Drug abuse is positively significant only in the South-South. This means that the effect of drug-related factors in the South-South is not driven by endogeneity bias.

Table 7: Random Effects Results (Geopolitical Zones)

*In*RTC	NW Coef.	Z	NE Coef.	z	NC Coef.	z	SW Coef.	Z	SS Coef.	z	SE Coef.	z
*In*VOL	-0.064	-1.28	-0.066*	-1.72	-0.078**	-2.35	0.072	0.85	-0.092	-0.76	0.011	0.11
*ln*IGR	0.086	0.39	0.61	0.44	0.281	0.88	0.311	1.42	-0.996	-1.56	0.212	0.55
UNE	0.044***	4.91	0.0338***	4.05	0.029***	5.42	-0.001	-0.05	0.024*	1.68	0.029*	1.89
*ln*DRUG	0.469	1.44	0.465	0.38	-0.535	-0.57	0.13	0.31	2.663**	2.55	0.327	0.66
constant	-3.217	-0.76	-15.35	-0.65	5.322	0.35	-3.944	-1.34	-5.838	-1.07	-4.97	-0.70
Group	7		6		7		6		6		5	

Note that: (***),(**) and (*) imply statistically significant at 1%, 5%, 10% respectively

Table 8: Hausman-Taylor Results (Geopolitical Zones)

*In*RTC	NW Coef.	z	NE Coef.	z	NC Coef.	z	SW Coef.	Z	SS Coef.	z	SE Coef.	z
*ln*VOL	-0.062	4.95	-0.073**	5.29	-0.077**	4.89	-0.081*	-1.77	-0.119	-1.35	-0.007	-0.09
*ln*IGR	0.087	-1.26	0.598	-2.37	0.282	-2.11	0.430	1.10	-0.939	-1.00	0.215	0.40
UNE	0.044***	0.37	0.035***	0.33	0.028***	1.13	0.033***	3.23	0.031***	3.12	0.037***	3.00
*In*DRUG	0.466	1.35	0.481	0.30	-0.535	-0.72	-0.225	-0.32	2.599*	1.68	0.314	0.46
constant	-3.199	-0.71	-15.287	-0.49	5.309	0.45	-2.243	-0.43	-6.467	-0.81	-4.978	-0.51
Group	7		6		7		6		6		5	

Note that: (***),(**) and (*) imply statistically significant at 1%, 5%, 10% respectively

Source: Authors' computation, 2026

4.3 Robustness check

To further examine the robustness of the baseline estimate, we use a random-effects estimator with robust standard errors, Hausman-Taylor and Negative Binomial (NB) regression. The random-effects robust specification addresses heteroskedasticity. Hausman-Taylor confirms robustness to endogeneity, meaning the significant variables are not driven by correlation between regressors and unobserved effects. An NB estimator is adopted to address the concern that our main result could be an artefact of the log-linear functional form rather than a genuine relationship. The likelihood ratio test of $\alpha = 0$ ($\chi^2 = 9553.49$, $p < 0.001$) confirms significant over-dispersion in the road crashes data, justifying the adoption of the Negative Binomial estimator in this study. Raw road transport crashes are used rather than the logged version because NB estimators use a different functional form. Inflation volatility and unemployment remain statistically significant across the three estimators, with their coefficient signs remaining consistent with the baseline result. Inflation volatility remains significantly negatively associated with road crashes, suggesting that higher volatility reduces crashes, possibly through reduced transport demand due to higher costs, which in turn lowers traffic exposure. Similarly, unemployment shows a positive and significant relationship with road crashes, suggesting that poor labour market conditions increase the likelihood of calamities such as accidents by heightening economic vulnerability and overreliance on unsafe transport. The consistency of these variables across the random-effects, NB, and Hausman-Taylor estimators indicates that the estimated relationships are robust to heteroskedasticity, endogeneity bias, and functional-form misspecification. The robustness of these outcomes strengthens the validity of the baseline estimate and raises confidence that inflation volatility affects road transport accidents in Nigeria.

Table 9: Robustness Test

*In*RTC (use as a count variable in the NB estimator result)	RE.	Hausman Taylor	Negative Binomial(NB) Regression result
*In*VOL	-0.062*** (0.000)	-0.065*** (0.00)	-0.0747*** (0.00)
*In*DRUG	-0.002 (0.94)	-0.002 (0.455)	-0.0162 (0.532)
*In*IGR	0.228 (0.15)	0.228 (0.499)	0.301 (0.17)
UNE	0.033*** (0.00)	0.033*** (0.000)	0.034*** (0.00)

Constant	-0.694 (0.84)	-0.687 (545)	-1.913 (0.502)
Group	37	37	37
Wald Chi-square	0.000	0.000	
LR test (α=0)			$\chi^2 = 9553.49$, $p < 0.001$

Note that: (***),(**) and (*) imply statistically significant at 1%, 5%, 10% respectively

Source: Authors' computation, 2026

5.0 Conclusion and Policy Recommendations

This study examines the impact of inflation volatility on road accidents across Nigerian states using state-level panel data. In other words, the study investigates whether inflation volatility has influenced the rise in road transport crashes across Nigeria's states. The findings of this study show that inflation volatility negatively affects road transport crashes, and this effect is most pronounced across most geopolitical zones. Therefore, this study concludes that when inflation is volatile., households cut back on road travel due to rising fuel and transport costs. This means vehicle usage drops, especially for non-essential trips, reducing road exposure to accidents and, consequently, the number of crashes. This conclusion can be traced to the exposure hypothesis, which holds that the likelihood of a road transport accident increases with the level of exposure to road activities.

This finding has several policy implications. First, policymakers should prioritise complementing inflation-stabilisation measures with transportation-sector interventions, such as improved road infrastructure, subsidised public transit, and fuel price controls. These measures can ensure the safe and easy movement of people and goods despite fuel price changes, while still minimising the risk of accidents. Experience from countries such as France, Germany and Indonesia shows that transport subsidies and tax holidays can reduce transport costs during inflationary periods. Measures like this would preserve mobility and economic welfare while ensuring that reductions in road transport crashes are achieved through building a safer transport system rather than a reduction in road usage caused by inflation volatility.

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