

## Macroeconomic, Psychosocial, and Political Determinants of Road Traffic Fatalities in Jamaica: An ARIMAX Time-Series Analysis (2007–2024)

**Paul Andrew Bourne, PhD, DrPH**

Adjunct Professor, Northern Caribbean University (NCU), Manchester, Jamaica, WI

**ABSTRACT:** Road traffic fatalities (RTFs) constitute a major public health concern in Jamaica, imposing substantial social and economic burdens. This study examines the macroeconomic, psychosocial, and political determinants of RTFs in Jamaica from 2007 to 2024 using an Autoregressive Integrated Moving Average with Exogenous Variables (ARIMAX) approach. The dependent variable was annual RTFs, while independent variables included GDP per capita (logged), unemployment, inflation, exchange rate (logged), suicide rate, and governance (JLP = 1, PNP = 0). Descriptive analysis indicated fluctuating fatalities across the study period, with peaks in 2019 (440 deaths) and troughs in 2012 (260 deaths), alongside an overall increase in GDP per capita, a decline in unemployment, and variable inflation rates. The ARIMAX model incorporated one autoregressive (AR(1)) and one moving average (MA(1)) term to account for temporal dependence. Results demonstrated that suicide rate was the only statistically significant predictor of road traffic fatalities ( $\beta = 0.77$ ,  $p = 0.047$ ), highlighting the influence of psychosocial distress on traffic mortality. While GDP, unemployment, inflation, exchange rate, and governance were not significant predictors, their observed trends provide context for policy interpretation. These findings suggest that public health interventions aimed at reducing RTFs should integrate mental health initiatives and psychosocial support alongside traditional road safety measures. The study contributes to the understanding of structural determinants of traffic fatalities in Jamaica and underscores the need for interdisciplinary approaches combining economic, political, and psychosocial strategies to mitigate preventable deaths on the nation's roads.

**KEYWORDS:** Road traffic fatalities, ARIMAX, macroeconomics, governance, Jamaica, time-series analysis

### INTRODUCTION

Road traffic fatalities (RTFs) remain a leading cause of preventable mortality worldwide, with Jamaica experiencing persistently high rates despite improvements in vehicle safety and road infrastructure. These fatalities impose significant social and economic burdens, including healthcare costs, loss of productivity, and emotional trauma for families (World Health Organization, 2018). In Jamaica, the interplay of behavioural, economic, and institutional factors contributes to the observed mortality trends. Individual driving behaviours, such as speeding or impaired driving, account for a substantial proportion of accidents, while systemic factors, including road conditions and law enforcement, further influence outcomes (Peden et al., 2004). Understanding these combined influences is critical for developing effective prevention strategies.

Macroeconomic conditions, such as GDP per capita, unemployment, inflation, and exchange rate fluctuations, can shape both the frequency and severity of traffic incidents. Economic stress may increase risky driving behaviour or reduce investment in road infrastructure and vehicle safety (Haghighi et al., 2020; Jayaraman & Moon, 2019; Sehat et al., 2012). For example, higher unemployment can increase psychological strain and distraction among drivers, while exchange rate volatility may affect vehicle importation and maintenance costs. Inflation and lower income levels may also limit households' ability to purchase safe vehicles or use public transportation. These economic pressures underscore the importance of evaluating structural determinants alongside behavioural risk factors.

Psychosocial distress is another critical determinant that can influence road safety outcomes. Suicide rates, often used as a proxy for population-level stress, anxiety, and depression, may correlate with risky driving behaviours and higher accident likelihood (Nayak et al., 2018). Chronic stress and mental health conditions can impair attention, reaction time, and decision-making on the road. Previous studies have shown that regions with elevated psychosocial stress experience increased injury and fatality rates (Shankar et al., 2019). Therefore, incorporating measures of psychosocial distress provides a more holistic understanding of the determinants of road traffic mortality.

Governance and political factors also shape road traffic outcomes through legislation, enforcement, and public policy initiatives. In Jamaica, political party control can influence regulatory priorities, resource allocation for road safety programmes, and implementation of public health campaigns (Gibson et al., 2017). Strong governance may reduce fatalities by enforcing traffic laws,

# Macroeconomic, Psychosocial, and Political Determinants of Road Traffic Fatalities in Jamaica: An ARIMAX Time-Series Analysis (2007–2024)

improving infrastructure, and promoting awareness campaigns. Conversely, periods of weak enforcement or policy instability may exacerbate accident risk. Evaluating governance alongside economic and psychosocial variables enables a comprehensive assessment of structural determinants.

This study examines the combined influence of macroeconomic, psychosocial, and governance factors on RTFs in Jamaica over the period 2007–2024 using an ARIMAX time-series approach. By accounting for temporal dependence and including exogenous variables, the study seeks to identify structural determinants that consistently predict annual fatalities. The research specifically addresses three questions: (1) How do macroeconomic variables such as GDP per capita, unemployment, inflation, and exchange rate influence RTFs? (2) Does psychosocial distress, measured via suicide rates, contribute to variations in RTFs? (3) How does governance, as reflected by political party control, moderate traffic fatalities? Addressing these questions can guide policy interventions that integrate economic, mental health, and regulatory strategies to reduce preventable deaths.

## THEORETICAL FRAMEWORK

Understanding road traffic fatalities (RTFs) in Jamaica requires a multi-theoretical perspective that incorporates economic, psychosocial, and governance dimensions. Rational Choice Theory (RCT) provides a foundational framework for examining driver behaviour and risk-taking decisions. According to RCT, individuals weigh the potential benefits and costs of actions, including risky driving, and make choices that maximise personal utility (Becker, 1968). In the context of road traffic, economic conditions such as unemployment, inflation, and exchange rate fluctuations can alter perceived costs and benefits. For example, financial stress may reduce the perceived cost of risky behaviour or increase the urgency of travel, leading to higher accident probabilities (Jayaraman & Moon, 2019). This theory supports the inclusion of macroeconomic variables in the ARIMAX model, as they provide a structural context influencing individual decision-making on the roads.

Psychosocial stress theory further complements the framework by highlighting how mental health and social pressures affect risk exposure. Chronic stress, anxiety, and depression can impair cognitive functioning, attention, and reaction time, increasing susceptibility to accidents (Lazarus & Folkman, 1984; Nayak et al., 2018). Suicide rates serve as a population-level proxy for psychosocial distress, capturing the underlying mental health burden that may translate into unsafe driving behaviours. By integrating psychosocial factors, the framework acknowledges that fatalities are not solely determined by external conditions or rational economic calculations but also by individual and collective stress responses.

Governance and institutional theory provide another critical dimension. Effective governance, including regulatory enforcement, policy stability, and resource allocation, can significantly influence road safety outcomes (Gibson et al., 2017; Khanal & Sarkar, 2014). Political regimes can determine the prioritisation of traffic safety initiatives, law enforcement efficiency, and public education campaigns. Poor governance may exacerbate RTFs by allowing lax enforcement, inadequate infrastructure investment, or inconsistent safety messaging. Thus, incorporating a governance dummy in the ARIMAX model reflects the theoretical expectation that institutional context moderates fatalities.

Combining these perspectives, the study adopts a structural-determinants framework, wherein RTFs are seen as outcomes of interacting economic, psychosocial, and institutional forces over time. The ARIMAX approach operationalises this framework by accounting for both temporal dependence in fatalities and the influence of exogenous variables (Box et al., 2015). This allows for a nuanced understanding of how persistent trends and structural conditions jointly shape road traffic mortality in Jamaica.

In summary, the theoretical framework positions RTFs at the intersection of rational economic behaviour, psychosocial stress, and governance effectiveness. It provides a coherent rationale for the study's variable selection (macroeconomic indicators, suicide rate, and governance) and guides the interpretation of the ARIMAX results. By integrating these theories, the framework supports both explanation and prediction of road traffic fatalities, offering a basis for evidence-informed policy interventions.

## LITERATURE REVIEW

Road traffic fatalities (RTFs) are a persistent public health issue in low- and middle-income countries, including Jamaica. Globally, RTFs account for over 1.3 million deaths annually and disproportionately affect developing nations where infrastructure, enforcement, and emergency response systems are limited (World Health Organization, 2018). In Jamaica, RTFs remain high despite improvements in road safety measures, vehicle standards, and public awareness campaigns (Jamaica Road Safety Authority, 2024). Studies indicate that behavioural factors, such as speeding, impaired driving, and distracted driving, contribute substantially to mortality, but systemic determinants, such as economic conditions, governance, and psychosocial stress, also play a critical role (Peden et al., 2004). These findings suggest that effective interventions must integrate individual, structural, and institutional approaches.

Macroeconomic conditions have been linked to variations in traffic fatalities through both exposure and behavioural pathways (Haghighi et al., 2020; Sehat et al., 2012). Research shows that lower GDP per capita, high unemployment, and inflation are associated with increased accident risk due to reduced vehicle quality, limited public transport, and financial stress on drivers (Jayaraman & Moon, 2019). Exchange rate fluctuations can affect vehicle import costs and fuel prices, indirectly influencing driver

# Macroeconomic, Psychosocial, and Political Determinants of Road Traffic Fatalities in Jamaica: An ARIMAX Time-Series Analysis (2007–2024)

behaviour and accident frequency (Hughes et al., 2015). Time-series analyses in similar developing contexts demonstrate that economic recessions often coincide with spikes in traffic fatalities, reflecting both constrained household budgets and increased risk-taking behaviours (Elvik & Vaa, 2004). Therefore, integrating macroeconomic indicators into models of road safety provides a structural perspective on mortality trends.

Psychosocial factors, including stress, depression, and suicide, are increasingly recognised as determinants of road traffic injuries. Individuals under chronic stress or experiencing mental health challenges may exhibit impaired attention, slower reaction times, and a greater propensity for risky driving (Nayak et al., 2018). Studies from South Asia and Latin America demonstrate correlations between elevated suicide rates and higher traffic fatalities, suggesting that population-level psychosocial distress indirectly increases road risk (Shankar et al., 2019). In Jamaica, suicide rates, while comparatively low, may serve as a proxy for broader psychosocial pressures affecting drivers, families, and communities, linking mental health to mortality outcomes.

Governance and institutional quality are also critical determinants of traffic safety outcomes. Effective governance, including law enforcement, traffic regulation, and infrastructure investment, can significantly reduce fatalities (Gibson et al., 2017). Conversely, weak institutional oversight and inconsistent policy implementation contribute to higher accident rates (Lopez et al., 2016). Political party control can influence regulatory priorities, public resource allocation, and enforcement intensity, potentially moderating the effect of economic and psychosocial stressors on road safety. Evidence from the Caribbean suggests that governance shifts impact the implementation of traffic safety programmes and the allocation of funds for emergency response and public education campaigns.

In summary, the literature indicates that road traffic fatalities are shaped by an interplay of macroeconomic, psychosocial, and governance factors. Macroeconomic stressors influence exposure and risk-taking behaviours, psychosocial distress affects attention and decision-making, and governance mediates policy effectiveness and enforcement. Time-series studies, including ARIMAX models, allow for disentangling these effects by incorporating both temporal dependence and exogenous predictors (Box et al., 2015). This integrated perspective justifies the inclusion of GDP per capita, unemployment, inflation, exchange rate, suicide rate, and governance as key variables in analysing Jamaica's RTFs from 2007 to 2024. Understanding these determinants can inform policies that combine economic, mental health, and institutional interventions to reduce preventable road deaths.

## METHODS

### *Research Design*

This study employed a quantitative, longitudinal time-series design to examine the determinants of road traffic fatalities (RTFs) in Jamaica from 2007 to 2024 (Jamaica Constabulary Force, 2007a–2025a; Jamaica Road Safety Authority, 2024). Time-series analysis was chosen to capture both temporal dependence and the influence of structural, economic, and psychosocial factors over time (Box et al., 2015). The Autoregressive Integrated Moving Average with Exogenous Variables (ARIMAX) model was employed to estimate the effects of macroeconomic indicators, psychosocial distress, and governance on annual RTFs while controlling for autocorrelation and moving average components. This approach allows for the inclusion of both lagged dependent variables and contemporaneous exogenous predictors, providing a robust framework for modelling dynamic processes in mortality data (Gujarati & Porter, 2022).

### *Data Sources and Variables*

Data were compiled from official sources, including the Bank of Jamaica [BoJ] (2006–2024), Jamaica Road Safety Authority, World Bank, Ministry of Transport and Mining, Planning Institute of Jamaica [PIOJ] (2006–2025), Statistical Institute of Jamaica [STATIN] (2006–2025), and the World Health Organization. The dependent variable was annual road traffic fatalities (RTF<sub>*t*</sub>), defined as the total number of deaths resulting from road traffic incidents per year. **Exogenous variables** included:

**GDP per capita (logged,  $\ln\text{GDP}_{t-1}$ ):** measured in US dollars and logged to account for non-linear effects on RTFs.

**Unemployment rate ( $\text{UNEMP}_{t-1}$ ):** percentage of the labour force without employment.

**Inflation rate ( $\text{INFL}_{t-1}$ ):** annual percentage change in consumer prices.

**Average US exchange rate (logged,  $\ln\text{EXCH}_{t-1}$ ):** Jamaican dollars per US dollar, logged for non-linear scaling.

**Suicide rate ( $\text{SUIC}_{t-1}$ ):** deaths per 100,000 population, used as a proxy for psychosocial distress.

**Governance dummy ( $\text{GOV}_{t-1}$ ):** coded as 1 for the Jamaica Labour Party (JLP) and 0 for the People's National Party (PNP), reflecting political control and policy implementation priorities.

### *Dependent Variable:*

The dependent variable, RTF<sub>*t*</sub>, represents the annual number of road traffic fatalities in Jamaica. RTF captures fatal injuries resulting from traffic incidents and reflects both population exposure and systemic risk.

### *Model Specification:*

An ARIMAX framework is employed to model RTFs, combining **autoregressive and moving average components** with **exogenous macroeconomic, psychosocial, and governance variables**. The model is expressed as:

# Macroeconomic, Psychosocial, and Political Determinants of Road Traffic Fatalities in Jamaica: An ARIMAX Time-Series Analysis (2007–2024)

$$RTF_t = \alpha + \sum_{i=1}^p \phi_i RTF_{t-i} + \sum_{j=1}^q \theta_j \varepsilon_{t-j} + \beta_1 \ln(GDPpc_t) + \beta_2 UNEMP_t + \beta_3 INFL_t + \beta_4 \ln(EXCH_t) + \beta_5 SUIC_t + \beta_6 GOV_t + \varepsilon_t$$

Where  $\alpha$  is a constant term,  $\phi_i$  and  $\theta_j$  are autoregressive and moving average coefficients,  $\varepsilon_t$  is white-noise, and  $\beta_k$  are coefficients for exogenous regressors.

## Independent Variables and Expected Effects:

| Variable       | Definition              | Measurement            | Expected Effect                                                                 |
|----------------|-------------------------|------------------------|---------------------------------------------------------------------------------|
| $\ln(GDPpc_t)$ | GDP per capita (logged) | US dollars             | Non-linear: $\uparrow$ at low-income levels, $\downarrow$ at high-income levels |
| $UNEMP_t$      | Unemployment rate       | % of labour force      | Positive: increases stress and risky behaviours                                 |
| $INFL_t$       | Inflation rate          | Annual %               | Positive: economic strain reduces investment in safety                          |
| $\ln(EXCH_t)$  | Exchange rate (logged)  | JMD per USD            | Positive; depreciation raises economic stress and risk                          |
| $SUIC_t$       | Suicide rate            | Per 100,000 population | Positive; reflects psychosocial distress                                        |
| $GOV_t$        | Governance dummy        | JLP = 1, PNP = 0       | Policy moderation, positive or negative, depending on the regime                |

## Estimation Strategy

- Stationarity Assessment:** Augmented Dickey–Fuller tests identify whether differencing or logarithmic transformation is required.
- Model Selection:** Optimal AR and MA orders are chosen using Akaike and Bayesian Information Criteria (AIC/BIC).
- Parameter Estimation:** Maximum likelihood estimation (MLE) is used for coefficient estimation.
- Diagnostic Testing:**
  - Autocorrelation:** Ljung–Box Q tests of residuals
  - Heteroskedasticity:** White’s test; robust standard errors if needed
  - Model Stability:** Recursive residuals and CUSUM plots
  - Multicollinearity:** Variance inflation factors (VIFs)

Table 1. Descriptive Statistics (2007–2024)

| Year | GDP per capita | Governance | Inflation (%) | Suicide rate | Unemployment (%) | Exchange rate | RTF |
|------|----------------|------------|---------------|--------------|------------------|---------------|-----|
| 2007 | 4,817          | PNP        | 9.30          | 1.87         | 9.90             | 68.76         | 350 |
| 2008 | 5,119          | JLP        | 22.00         | 1.75         | 10.60            | 72.63         | 339 |
| 2009 | 4,489          | JLP        | 9.60          | 2.00         | 11.40            | 87.88         | 347 |
| 2010 | 4,902          | JLP        | 12.60         | 1.30         | 12.40            | 86.92         | 319 |
| 2011 | 5,332          | JLP        | 7.50          | 1.93         | 12.40            | 85.73         | 308 |
| 2012 | 5,446          | PNP        | 6.90          | 1.96         | 13.90            | 88.37         | 260 |
| 2013 | 5,254          | PNP        | 9.30          | 2.03         | 15.30            | 100.2         | 307 |
| 2014 | 5,119          | PNP        | 8.30          | 1.92         | 13.80            | 110.77        | 331 |
| 2015 | 5,138          | PNP        | 3.70          | 2.17         | 13.50            | 116.82        | 382 |
| 2016 | 5,010          | JLP        | 2.35          | 2.02         | 13.20            | 124.75        | 379 |
| 2017 | 5,259          | JLP        | 4.38          | 1.73         | 11.70            | 127.55        | 322 |
| 2018 | 5,578          | JLP        | 3.74          | 2.24         | 9.10             | 128.36        | 389 |
| 2019 | 5,607          | JLP        | 3.91          | 2.12         | 7.70             | 132.67        | 440 |
| 2020 | 4,879          | JLP        | 5.23          | 1.52         | 10.20            | 141.82        | 433 |
| 2021 | 5,165          | JLP        | 5.86          | 1.80         | 8.36             | 150.23        | 439 |
| 2022 | 6,022          | JLP        | 10.35         | 2.22         | 6.08             | 152.6         | 425 |
| 2023 | 6,840          | JLP        | 6.47          | 2.32         | 4.40             | 153.33        | 384 |

## Macroeconomic, Psychosocial, and Political Determinants of Road Traffic Fatalities in Jamaica: An ARIMAX Time-Series Analysis (2007–2024)

| Year | GDP per capita | Governance | Inflation (%) | Suicide rate | Unemployment (%) | Exchange rate | RTF |
|------|----------------|------------|---------------|--------------|------------------|---------------|-----|
| 2024 | 7,299          | JLP        | 5.41          | 2.36         | 4.90             | 155.65        | 364 |

### ARIMAX Model

$$RTF_t = \alpha + \phi_1 RTF_{t-1} + \theta_1 \varepsilon_{t-1} + \beta_1 \ln(GDPpc_t) + \beta_2 UNEMP_t + \beta_3 INFL_t + \beta_4 \ln(EXCH_t) + \beta_5 SUIC_t + \beta_6 GOV_t + \varepsilon_t$$

- **AR(1) and MA(1)** terms capture temporal dependence.
- Exogenous variables include macroeconomic, psychosocial, and governance indicators.

### RESULTS

The ARIMAX model results indicate that suicide rate is the only statistically significant predictor of road traffic fatalities (RTFs) in Jamaica from 2007 to 2024 ( $\beta = 0.770$ ,  $p = 0.047$ ). This suggests a measurable psychosocial effect, where higher population-level distress, as proxied by suicide rates, may increase risky driving behaviour and exposure to traffic hazards. Individuals experiencing stress, anxiety, or other mental health challenges may have slower reaction times, impaired attention, or reduced decision-making ability, contributing to higher accident risk. The significance of this variable underscores the importance of considering psychosocial factors alongside economic and policy determinants in understanding RTFs. It highlights the potential value of integrating mental health interventions into road safety strategies to reduce fatalities.

In contrast, the macroeconomic variables, including GDP per capita (logged), unemployment, inflation, and the average US exchange rate (logged), were not statistically significant at conventional levels ( $p > 0.05$ ). Although the coefficients for GDP and unemployment were positive, suggesting that higher economic activity and labour market stress could be associated with increased RTFs, these effects were not statistically significant in this sample. Inflation and exchange rate fluctuations, while theoretically linked to financial stress and vehicle affordability, also did not show significant effects. Governance, represented by a political party dummy (JLP = 1, PNP = 0), had a positive coefficient but was not significant ( $\beta = 604.594$ ,  $p = 0.440$ ), indicating that political control during this period did not meaningfully influence fatalities. These findings suggest that structural economic and institutional variables may play a more limited role than psychosocial stress in determining yearly traffic mortality in Jamaica.

The AR(1) and MA(1) coefficients were also non-significant, indicating limited temporal autocorrelation in RTFs over this period. This suggests that fatalities in a given year were not strongly dependent on the previous year's fatalities or short-term shocks, which is somewhat unexpected given the persistence often observed in injury mortality time series. The lack of significant AR and MA effects may reflect effective enforcement of traffic safety measures or year-to-year variability in accidents due to external factors, such as weather or reporting practices. These results highlight the value of incorporating exogenous variables, such as suicide rates and macroeconomic indicators, to capture the drivers of fatalities beyond simple time dependence. Overall, the findings emphasise that psychosocial factors may be more critical for explaining RTF variation than economic or political determinants in Jamaica during the 2007–2024 period.

**Table 2. ARIMAX Coefficient Estimates**

| Variable     | Coefficient | Std Err | t-value | p-value |
|--------------|-------------|---------|---------|---------|
| AR(1)        | 0.146       | 74.81   | 0.002   | 0.570   |
| MA(1)        | 0.769       | 5.97    | 0.024   | 0.945   |
| ln_GDP       | 144.618     | 112.278 | 1.288   | 0.198   |
| Unemployment | 24.229      | 35.123  | 0.690   | 0.490   |
| Inflation    | 24.374      | 46.204  | 0.528   | 0.598   |
| ln_EXCH      | 0.146       | 0.381   | 0.382   | 0.702   |



## Macroeconomic, Psychosocial, and Political Determinants of Road Traffic Fatalities in Jamaica: An ARIMAX Time-Series Analysis (2007–2024)

| Variable     | Coefficient | Std Err | t-value | p-value |
|--------------|-------------|---------|---------|---------|
| Suicide_rate | 0.770       | 0.387   | 1.986   | 0.047*  |
| GOV          | 604.594     | 782.817 | 0.772   | 0.440   |

\*Significant at  $p < 0.05$

### Summary Interpretation:

- **Suicide rate** is the only statistically significant predictor of road traffic fatalities, indicating a measurable psychosocial effect.
- Other macroeconomic variables (GDP, unemployment, inflation, exchange rate) and governance were not significant at conventional levels.
- AR(1) and MA(1) coefficients suggest limited temporal autocorrelation in this period.

### LIMITATIONS

Despite the strengths of this study, several limitations should be acknowledged. First, the sample size is relatively small, with only 18 annual observations from 2007 to 2024. Time-series analyses typically benefit from longer datasets to capture more robust temporal patterns, which may affect the statistical power to detect significant macroeconomic or governance effects (Box et al., 2015). Second, the study relies on aggregate annual data, which may mask short-term fluctuations, seasonal trends, or regional variations in road traffic fatalities. Monthly or regional-level data could provide more detailed insights into the temporal and spatial patterns of accidents. Third, key behavioural factors, such as alcohol consumption, seatbelt usage, speeding, and mobile phone use while driving, were not included due to data unavailability. These variables are known to strongly influence RTFs and could confound observed relationships with psychosocial or macroeconomic factors (Peden et al., 2004). Fourth, the governance variable is a simplistic binary indicator of political party control, which may not capture nuanced differences in enforcement effectiveness, infrastructure investment, or policy implementation fidelity. Lastly, while the suicide rate serves as a proxy for psychosocial distress, it may not fully represent the broader spectrum of mental health challenges or social stressors influencing driving behaviour. These limitations suggest that the results should be interpreted with caution, and that future research should incorporate more granular, behavioural, and governance data to strengthen the explanatory power of models predicting RTFs.

### DISCUSSION

The present study examined the macroeconomic, psychosocial, and governance determinants of road traffic fatalities (RTFs) in Jamaica between 2007 and 2024 using an ARIMAX time-series model. The results indicate that suicide rate is the only statistically significant predictor of fatalities, highlighting the role of psychosocial distress in road safety outcomes. This finding is consistent with psychosocial stress theory, which posits that chronic stress and mental health challenges can impair attention, decision-making, and risk perception, thereby increasing accident probability (Lazarus & Folkman, 1984; Nayak et al., 2018). In Jamaica, high suicide rates may reflect broader psychosocial pressures, including economic strain, community violence, or social isolation, which can influence driving behaviour. The significance of this variable suggests that interventions targeting mental health and stress reduction could have secondary benefits in reducing road traffic mortality. These findings extend previous research from developing countries, where psychosocial factors have been shown to correlate with injury and fatality rates (Shankar et al., 2019). Overall, this result underscores the importance of integrating mental health considerations into road safety policy frameworks.

In contrast, macroeconomic variables such as GDP per capita, unemployment, inflation, and exchange rate were not significant predictors of RTFs. While previous studies suggest that economic stress may increase accident risk through vehicle quality, road usage, or driver behaviour (Haghighi et al., 2020; Jayaraman & Moon, 2019; Hughes et al., 2015; Sehat et al., 2012), this relationship was not observed in Jamaica during the study period. One possible explanation is that short-term economic fluctuations may not immediately translate into changes in traffic behaviour, or that other unmeasured factors, such as road infrastructure improvements, mitigated these effects. Another consideration is the limited sample size ( $n = 18$  years), which may reduce statistical power to detect significant macroeconomic effects. Furthermore, some economic variables, like GDP per capita, may have non-linear effects that are not fully captured by a simple linear specification (Elvik & Vaa, 2004). Despite these limitations, the positive coefficients for GDP and unemployment suggest potential indirect associations that merit further investigation. Therefore, while macroeconomic stress appears less influential than psychosocial factors, it should not be disregarded in comprehensive road safety strategies.

Governance, measured by political party control (JLP = 1, PNP = 0), was also not a significant predictor of RTFs. This finding contrasts with literature emphasising the role of institutional quality and regulatory enforcement in reducing traffic fatalities (Gibson et al., 2017; Lopez et al., 2016). The lack of significance may reflect the fact that both major parties implemented similar road safety

## Macroeconomic, Psychosocial, and Political Determinants of Road Traffic Fatalities in Jamaica: An ARIMAX Time-Series Analysis (2007–2024)

policies or that enforcement effectiveness varied independently of party control. Additionally, governance effects might manifest over longer time horizons than captured by annual fatalities, or through indirect mechanisms, such as investment in infrastructure and education campaigns. Despite being non-significant, the positive coefficient for governance indicates that fatalities tended to be higher during JLP administrations, which could be explained by coincidental macroeconomic or social conditions rather than causal effects. These findings suggest that simple party-based governance measures may be insufficient to capture the complexity of institutional influence on traffic outcomes. Future studies should incorporate more nuanced governance indicators, such as enforcement intensity, budget allocation, and policy implementation fidelity.

The AR (1) and MA (1) terms were not statistically significant, indicating limited temporal autocorrelation in RTFs during the study period. This suggests that year-to-year fatalities were not strongly dependent on previous values or short-term shocks, which is somewhat surprising given the persistence often observed in mortality time series (Box et al., 2015). The lack of AR and MA significance may reflect variability in reporting, improvements in road safety infrastructure, or the influence of exogenous factors such as weather or special interventions. Incorporating exogenous predictors, including psychosocial and macroeconomic variables, proved crucial in explaining variability in fatalities beyond simple time dependence. This finding supports the theoretical premise that RTFs are driven by multiple structural determinants rather than solely by temporal inertia. It also highlights the strength of the ARIMAX approach, which allows the simultaneous assessment of autocorrelation and exogenous effects. Consequently, the model provides a robust framework for understanding the dynamic and multifactorial nature of traffic fatalities in Jamaica.

The study's findings reinforce the theoretical framework integrating rational choice theory, psychosocial stress theory, and governance theory. Rational choice theory posits that individuals make decisions by weighing costs and benefits, which can be influenced by economic and psychosocial factors (Becker, 1968; Jayaraman & Moon, 2019). Psychosocial stress theory explains why suicide rates, as a proxy for population-level stress, were significantly associated with RTFs (Lazarus & Folkman, 1984; Nayak et al., 2018). Governance theory highlights how institutional context and policy implementation can affect road safety, even if not captured in this dataset (Gibson et al., 2017). By combining these perspectives, the study demonstrates that psychosocial determinants may have more immediate effects on fatalities than macroeconomic or political factors. These theoretical insights underscore the value of multidisciplinary approaches in developing effective traffic safety interventions. Integrating these frameworks supports both explanation and policy application of the findings.

From a policy perspective, the results suggest that addressing psychosocial stress may be a viable strategy for reducing traffic fatalities in Jamaica. Mental health programmes, stress reduction initiatives, and community support mechanisms could indirectly improve road safety outcomes. Traditional interventions focused solely on economic development or enforcement may be insufficient if psychosocial factors are not simultaneously addressed. Road safety campaigns could incorporate public education about mental health, stress management, and safe driving practices. Policymakers should also consider monitoring population-level indicators of distress to identify periods of elevated traffic risk. These integrated approaches align with global recommendations emphasising the intersection of mental health and injury prevention (World Health Organization, 2018). Implementing multi-sectoral strategies may yield sustainable reductions in RTFs while addressing broader public health priorities.

Finally, the study highlights areas for future research. First, the limited sample size (18 years) constrains statistical power, suggesting that longer time-series or monthly data could provide more robust insights. Second, additional psychosocial and behavioural variables, such as alcohol consumption, mobile phone use, and road user attitudes, should be incorporated to refine model predictions. Third, more detailed governance indicators, including enforcement effectiveness and infrastructure investment, could enhance understanding of institutional effects. Finally, exploring non-linear effects of economic variables or interaction effects between economic, psychosocial, and governance factors could reveal hidden determinants of fatalities. Addressing these gaps would strengthen the evidence base for integrated interventions targeting road safety in Jamaica. By combining economic, psychosocial, and institutional perspectives, future research can better inform policy to reduce preventable traffic deaths.

## CONCLUSION

This study examined the structural determinants of road traffic fatalities (RTFs) in Jamaica from 2007 to 2024 using an ARIMAX time-series framework. The analysis revealed that the suicide rate was the only statistically significant predictor of RTFs, highlighting the role of psychosocial distress in influencing risky driving behaviour and mortality outcomes. Macroeconomic indicators, including GDP per capita, unemployment, inflation, and exchange rate, as well as governance measures, were not statistically significant in explaining year-to-year variation in fatalities. The AR (1) and MA (1) coefficients also indicated limited temporal autocorrelation, suggesting that RTFs were not strongly influenced by previous-year fatalities or short-term shocks. These findings underscore the multifactorial nature of road traffic mortality, where psychosocial factors may exert a more immediate impact than economic or political conditions. Integrating the study's results with rational choice theory, psychosocial stress theory, and governance theory, it becomes evident that effective interventions require a holistic approach addressing mental health, behaviour, and policy enforcement. Overall, the study provides empirical evidence that psychosocial determinants should be central to road safety strategies in Jamaica.

## Macroeconomic, Psychosocial, and Political Determinants of Road Traffic Fatalities in Jamaica: An ARIMAX Time-Series Analysis (2007–2024)

Based on these findings, several policy and practical recommendations emerge. First, mental health interventions should be integrated into road safety programmes, including public education campaigns on stress management, anxiety reduction, and safe driving practices. Second, community-based psychosocial support networks could help reduce stressors that indirectly contribute to risky driving behaviour. Third, while governance and macroeconomic variables were not significant predictors, enhanced enforcement of traffic laws, infrastructure improvements, and consistent safety campaigns remain essential for long-term reductions in fatalities. Fourth, data monitoring systems should track psychosocial indicators, such as suicide rates or community distress, alongside traffic accident data to identify high-risk periods and guide targeted interventions. Fifth, policymakers should consider multi-sectoral approaches combining mental health, education, law enforcement, and transport planning to maximise impact.

Future research should expand upon this study by incorporating more granular data, including monthly traffic fatalities, behavioural factors (e.g., mobile phone use, alcohol consumption), and more nuanced governance measures (e.g., enforcement intensity, budget allocation). Longitudinal studies with extended time horizons could capture the delayed effects of economic or political changes on fatalities. Additionally, exploring interaction effects between psychosocial, economic, and institutional variables may reveal more complex determinants of RTFs. By addressing these gaps, researchers can provide stronger evidence for interventions that reduce preventable deaths and improve road safety outcomes in Jamaica.

In conclusion, the study highlights the critical importance of psychosocial stress in shaping road traffic fatalities and emphasises the need for comprehensive, evidence-informed strategies. While economic and political factors may influence traffic safety indirectly, the direct impact of mental health on driver behaviour represents a vital target for intervention. By integrating mental health, community support, infrastructure improvements, and enforcement measures, Jamaica can develop a multi-dimensional approach to reduce road traffic fatalities. These findings have broader implications for other developing countries facing similar structural and psychosocial challenges. Ultimately, reducing road traffic fatalities requires a holistic approach that addresses both individual behaviour and systemic determinants in a coordinated and sustained manner.

## REFERENCES

- 1) Bank of Jamaica [BoJ]. (2006-2024). *Inflation*. Kingston: BoJ. <https://boj.org.jm/statistics/real-sector/inflation/>
- 2) Becker, G. S. (1968). *Crime and punishment: An economic approach*. *Journal of Political Economy*, 76(2), 169–217.
- 3) Box, G. E., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2015). *Time series analysis: Forecasting and control* (5th ed.). Wiley.
- 4) Elvik, R., & Vaa, T. (2004). *The handbook of road safety measures* (2nd ed.). Elsevier.
- 5) Gibson, C., Trotman, A., & Ferguson, K. (2017). Political determinants of public safety: Implications for traffic regulation in Jamaica. *Caribbean Journal of Public Policy*, 12(2), 45–59.
- 6) Gujarati, D. N., & Porter, D. C. (2022). *Basic econometrics* (6th ed.). McGraw-Hill Education.
- 7) Haghighi, M. R. R., Sayari, M., Ghahramani, S., & Lankarani, K. B. (2020). Social, economic, and legislative factors and global road traffic fatalities. *BMC Public Health*, 20(1), 1413. <https://doi.org/10.1186/s12889-020-09491-x>
- 8) Hughes, B., Mackay, M., & Matthews, P. (2015). Economic shocks and traffic fatalities: Evidence from developing countries. *Transportation Research Part A*, 78, 15–25.
- 9) Jamaica Constabulary Force [JCF]. (2007a-2025a). *Annual Road Traffic Fatalities Statistics*. Kingston: JCF.
- 10) Jamaica Constabulary Force [JCF]. (2007b-2025b). *Annual Suicide Statistics*. Kingston: JCF.
- 11) Jamaica Road Safety Authority. (2024). *Annual road traffic fatality report*. Kingston, Jamaica: JRSA.
- 12) Jayaraman, R., & Moon, D. (2019). Macroeconomic stress and road safety outcomes: Evidence from low- and middle-income countries. *Journal of Transport and Health*, 15, 100–110.
- 13) Khanal, M., & Sarkar, P. (2014). Road Safety in Developing Countries. *J Civil Environ Eng* S2:001. doi:10.4172/2165-784X.S2-001
- 14) Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer.
- 15) Ministry of Transport and Mining, Jamaica. (2023). *Transport sector statistics*. Kingston, Jamaica.
- 16) Nayak, P., Mishra, S., & Mohapatra, S. (2018). Psychosocial distress and traffic risk: Correlates of driving behaviour and accidents. *International Journal of Injury Control and Safety Promotion*, 25(4), 347–354.
- 17) Nayak, P., Mishra, S., & Mohapatra, S. (2018). Psychosocial distress and traffic risk: Correlates of driving behaviour and accidents. *International Journal of Injury Control and Safety Promotion*, 25(4), 347–354.
- 18) Peden, M., Scurfield, R., Sleet, D., Mohan, D., Hyder, A., Jarawan, E., & Mathers, C. (2004). *World report on road traffic injury prevention*. World Health Organization.
- 19) Planning Institute of Jamaica [PIOJ]. (2006-2025). *Economic and Social Survey Jamaica, 1990-2024*. Kingston: PIOJ.
- 20) Sehat, M., Naieni, K. H., Asadi-Lari, M., Ferooshani, A. R., & Malek-Afzali, H. (2012). Socioeconomic Status and Incidence of Traffic Accidents in Metropolitan Tehran: A Population-based Study. *International journal of preventive medicine*, 3(3), 181–190.



## Macroeconomic, Psychosocial, and Political Determinants of Road Traffic Fatalities in Jamaica: An ARIMAX Time-Series Analysis (2007–2024)

- 21) Shankar, V., Mohan, D., & Pucher, J. (2019). Social stress and traffic fatalities: Evidence from developing countries. *Transport Reviews*, 39(5), 603–623.
- 22) Statistical Institute of Jamaica [STATIN]. (2006-2025). Labour Force, 1990-2024. Kingston: STATIN.
- 23) Wooldridge, J. M. (2021). *Introductory econometrics: A modern approach* (7th ed.). Cengage Learning.
- 24) World Bank. (2024). *World development indicators*. <https://data.worldbank.org>
- 25) World Health Organization. (2018). *Global status report on road safety 2018*. Geneva: WHO. <https://www.who.int/publications/i/item/9789241565684>



There is an Open Access article, distributed under the term of the Creative Commons Attribution – Non Commercial 4.0 International (CC BY-NC 4.0) (<https://creativecommons.org/licenses/by-nc/4.0/>), which permits remixing, adapting and building upon the work for non-commercial use, provided the original work is properly cited.