International Journal of Innovative Mathematics, Statistics & Energy Policies
14(1):115-132, Jan.-Mar., 2026

 www.seahipublications.org ISSN: 2467-852X

doi:10.5281/zenodo.18915924

A Mathematical Framework For Analyzing The Impact Of Political Events On Nigeria's Economic Indicators Using Maximum Likelihood Estimation

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ABSTRACT

This study investigates the impact of political events on Nigeria's key economic indicators: GDP growth, unemployment, and inflation, using the Maximum Likelihood Estimation (MLE) technique. The main objective is to analyze how different political conditions, election years, non-election years, and policy reform years, affect macroeconomic stability. Three independent MLE models were estimated, one for each indicator, to obtain efficient estimates of the mean, variance, and sensitivity coefficients. The likelihood function was maximized for each model to determine the parameters that best describe the observed data. The results show that GDP growth averages 4.29%, 5.56%, and 4.20% with a variance of 21.1 and a log-likelihood (InL) of –73.595. Unemployment averages 4.11%, 4.24%, and 4.36% (variance = 0.52; InL = –27.19), while inflation averages 12.3%, 13.46%, and 17.32%, (variance = 32.64; InL = –79.05). All t-statistics are significant, indicating that political events exert measurable effects on macroeconomic performance. The study fills a methodological gap in existing literature, which often relied on linear regression without probabilistic estimation. By applying MLE to each indicator, the study provides a mathematically rigorous and probability-based framework for analyzing how political uncertainty influences economic outcomes. The findings reveal that political cycles increase macroeconomic instability in Nigeria, with inflation being the most sensitive indicator, followed by GDP growth and next to unemployment.

Keywords: Maximum Likelihood Estimation, political events, GDP growth, unemployment, inflation, probability modeling, economic stability, statistical analysis, applied Mathematics, macroeconomics.

INTRODUCTION

Macroeconomic performance in developing economies is often affected by political events such as elections, reforms, and policy changes. In Nigeria, recurrent fluctuations in GDP growth, unemployment, and inflation have frequently coincided with presidential election cycles and governance transitions (Okoli, 2025). Such political uncertainty generates stochastic disturbances that influence fiscal decisions, investment behavior, and consumption patterns, leading to measurable variations in key economic indicators. Understanding and quantifying these effects is essential for economic planning and policy formulation.(Lucas, 1973).

Theoretical foundations indicate that government policies and public spending can directly influence growth under endogenous growth theory (Mini et al 2025). Empirical studies provide strong evidence linking political instability to economic performance. Abdelhameed (2023) reported that instability weakens growth and investor confidence. Akinlo, *et al* (2022) found that political disruptions in Nigeria reduce productive activity and caused a slow in GDP growth. Similarly, Alesina *et al* (1996); Barro (1991) established that unstable political conditions reduce long-term growth by increasing uncertainty and lowering investment.

Previous studies have examined the relationship between political events and economic outcomes, but most have relied on linear regressions or descriptive statistics applied to individual indicators. For example, Seber and Lee, (2012), analyzed the impact of elections on GDP growth, while Aina (2025) focused on inflationary effects of political transitions. Mohammed et al (2025) studied unemployment dynamics during election periods. Ibrahim and Victor (2025); Ikeotuonye and Loveth (2026) highlighted macroeconomic volatility in policy reform years. Box and Jenkins(1976) applied time-series approaches but did not quantify stochastic relationships across multiple indicators. Casella and Berger (2002) emphasized the need for probabilistic estimation methods and statistical inference, while Ogwumu and James (2013) suggested rigorous mathematical modeling of political-economic interactions.

Recent analyses using Solow-type models highlight that structural factors and policy interventions are critical in shaping growth trajectories in Nigeria (Nwabenu, *et al* 2025). Within Nigeria, Drazan (2001) found that political events significantly influence GDP growth, while Akinlo (2021) identified that financial development interacts with political thresholds to affect economic performance in sub-Saharan Africa. Chen and Feng (1996) demonstrated that institutional consistency is vital for sustained growth; Gujarati and Porter (2022) observed similar patterns in Central and Eastern Europe. Okeke and Musa (2023) showed that inflation and GDP per capita respond strongly to macroeconomic and political instability, and Aina (2025) highlighted that demographic pressures exacerbate inequality and volatility. Furthermore, Nigerian studies have shown that multiple growth determinants, including fiscal policy and structural factors, jointly influence economic outcomes (Oladipo and Akinola 2023). These studies demonstrate that political events influence economic outcomes but leave two major gaps: $(i)$the lack of a unified mathematical estimation framework that can capture stochastic effects and (ii) limited comparative analysis of multiple macroeconomic indicators under political conditions.

To address these gaps, this study applies Maximum Likelihood Estimation (MLE) 'an established and widely applied statistical method in economics and applied mathematics' according to (Seber & Lee, 2012; Casella & Berger, 2002) to estimate the effects of presidential elections on three key macroeconomic indicators: GDP growth rate, unemployment rate, and inflation rate. Political events are categorized as presidential election years, non-election years, and policy reform years. The MLE framework allows estimation of mean, variance, and sensitivity coefficients, providing a probabilistic and mathematically rigorous assessment of each indicator's response to political shocks.

To model GDP growth, unemployment, and inflation as stochastic responses to political events of Nigeria from 1999 to 2023, we make use of MLE framework including all presidential election cycles and relevant policy reform periods. The justification for this work lies in its ability to offer policymakers and researchers a replicable, quantitative framework to measure the magnitude and variability of economic responses to presidential elections, which is largely absent in the current Nigerian literature.

MATERIALS AND METHODOLOGY

Data Collection

Data for this study were gotten from secondary sources. Data was collected for the years 1999 to 2023.

Data Sources for Economic Indicators were National Bureau of Statistics (NBS) Database, World Bank Database and International Monetary Fund (IMF) Database

Data Sources for Political Events were Official government publications, Reputable news outlets, Independent National Electoral Commission (INEC) Database, Academic journals and political analysis reports.

Data analysis was done using excel spreadsheet while PYTHON software was used to sketch the graphs.

Variable Specification and Model.

This study employs Maximum likelihood estimation (MLE) (Gujarati, 2022; Greene, 2020), a robust statistical approach that identifies parameter values maximizing the probability of observing the given data. Although MLE is well-established, it's application here is novel because it jointly estimates the behavior of three macroeconomic indicators in response to political events.

For this study, the dependent variables were: GDP Growth Rate (continuous variable), Inflation Rate (continuous variable) and Unemployment Rate (continuous variable).

The Independent Variables were: Election year, Non election year and Policy reform year.

The model expressing the relationship between economic indicators and political events is stated as:

$$y_t = \propto + \beta_1 E_t + \beta_2 P_t + \varepsilon_t \qquad -------(1)$$

where;

y_t = the economic indicators (such as GDP growth, Unemployment rate, Inflation rate) in year t

$\propto$ = average outcome in non-election years

β_1= parameter measuring the impact of election years

E_t = election – years dummy variable

β_2 = parameter measuring the effect of policy reform years

P_t = policy reform dummy variable

y_E = election years

y_N = non election years

y_N = policy reform years

ε_t = random error term.

It is assumed that the errors are independent and normally distributed with zero mean and constant variance, that is:

$$\varepsilon_t \sim N(O, \delta^2)$$

Thus, $\propto = \bar{y}_N,\ \beta_1 = \bar{y}_E - \bar{y}_N,\ \beta_2 = \bar{y}_p - \bar{y}_N \qquad -----(2)$

The Likelihood Function

For each observation y_t, the probability density function of a normal distribution is given as:

$$f(y_t/\propto, \beta_1, \beta_2, \delta^2) = \frac{1}{\sqrt{2\pi\delta^2}} \exp\left[-\frac{(y_t - \propto - \beta_1 E_t - \beta_2 P_t)^2}{2\delta^2}\right] \qquad -----(3)$$

Since the observations are independent, the likelihood function (the joint probability of observing all the data) is obtained by multiplying the individual densities together as:

$$L(\propto, \beta_1, \beta_2, \delta^2) = \prod_{t=1}^{n} \frac{1}{\sqrt{2\pi\delta^2}} \exp\left[-\frac{(y_t - \propto - \beta_1 E_t - \beta_2 P_t)^2}{2\delta^2}\right] \qquad -----(4)$$

The Log-Likelihood Function

To simplify computation, the natural logarithm of the likelihood function is taken. Hence, the log-likelihood function becomes:

$$InL = -\frac{n}{2} In(2\pi) - \frac{n}{2} In(\delta^2) - \frac{1}{2\delta^2} \sum_{t=1}^{n} (y_t - \propto - \beta_1 E_t - \beta_2 P_t)^2 \qquad -----(5)$$

The summation term represents the total squared deviations (errors). This can be denoted as the Residual Sum of Squared (RSS), given by:

$$\text{RSS} = \sum_{t=1}^{n} (y_t - \propto - \beta_1 E_t - \beta_2 P_t)^2 \qquad -----(6)$$

Substituting this expression for RSS into the log-logarithm equation gives the simplified form:

$$InL = -\frac{n}{2}In(2\pi) - \frac{n}{2}In(\delta^2) - \frac{RSS}{2\delta^2} \quad ------(7)$$

Derivation of the Maximum Likelihood Estimators;

To find the maximum likelihood estimators (MLEs), the log-likelihood function is differentiated with respect to each of the parameters

$\propto, \beta_1, \beta_2, and\ \delta^2$ and the resulting equations are set equal to zero.

Derivative with respect to $\propto$.

Recall:

RSS = $\sum_{t=1}^{n}(y_t - \propto - \beta_1 E_t - \beta_2 P_t)^2$

Differentiating RSS with respect to $\propto$:

$$\frac{RSS}{\partial\alpha} = \sum_{t=1}^{n} 2(y_t - \propto - \beta_1 E_t - \beta_2 P_t)(-1) \quad ------(8)$$

Simplifying:

$$\frac{RSS}{\partial\alpha} = -2\sum_{t=1}^{n}(y_t - \propto - \beta_1 E_t - \beta_2 P_t) \quad ------(9)$$

Differentiating the log-likelihood function with respect to $\propto$:

$$\frac{\partial InL}{\partial\alpha} = -\frac{1}{2\delta^2} \text{X} \frac{\partial \text{RSS}}{\partial\propto} \quad ------(10)$$

Substitute the result for $\frac{\text{RSS}}{\partial\propto}$:

$$\frac{\partial InL}{\partial \propto} = -\frac{1}{2\delta^2}\left[-2\sum_{t=1}^{n}(y_t - \propto - \beta_1 E_t - \beta_2 P_t)\right] \quad ------(11)$$

Simplify:

$$\frac{\partial InL}{\partial \propto} = \frac{1}{\delta^2}\sum_{t=1}^{n}(y_t - \propto - \beta_1 E_t - \beta_2 P_t) \quad ------(12)$$

Set the derivative equal to zero:

$$\sum_{t=1}^{n}(y_t - \propto - \beta_1 E_t - \beta_2 P_t) = 0 \quad ------(13)$$

Derivative with respect to β_1

Following the same steps:

$$\frac{RSS}{\partial\beta_1} = \sum_{t=1}^{n} 2(y_t - \propto - \beta_1 E_t - \beta_2 P_t)(-E_t) \quad ------(14)$$

Simplifying

$$\frac{RSS}{\partial\beta_1} = -2\sum_{t=1}^{n} E_t(y_t - \propto - \beta_1 E_t - \beta_2 P_t) \quad ------(15)$$

Differentiating the log-likelihood function with respect to : β_1

$$\frac{\partial InL}{\partial\beta_1} = -\frac{1}{2\delta^2} \text{X} \frac{\partial \text{RSS}}{\partial\beta_1} \quad ------(16)$$

Substitute the result for $\frac{\text{RSS}}{\partial \beta_1}$:

$$\frac{\partial InL}{\partial \beta_1} = -\frac{1}{2\delta^2}\left[-2\sum_{t=1}^{n} E_t(y_t - \propto - \beta_1 E_t - \beta_2 P_t)\right] \quad ------(17)$$

Simplify:

$$\frac{\partial InL}{\partial \beta_1} = \frac{1}{\delta^2}\sum_{t=1}^{n} E_t(y_t - \propto - \beta_1 E_t - \beta_2 P_t) \quad -----(18)$$

Set equal to zero:

$$\sum_{t=1}^{n} E_t(y_t - \propto - \beta_1 E_t - \beta_2 P_t) = 0 \quad ------(19)$$

Derivative with respect to β_2

Similarly:

$$\frac{RSS}{\partial \beta_2} = \sum_{t=1}^{n} 2(y_t - \propto - \beta_1 E_t - \beta_2 P_t)(-P_t) \; ------(20)$$

$$\frac{RSS}{\partial \beta_2} = -2\sum_{t=1}^{n} P_t(y_t - \propto - \beta_1 E_t - \beta_2 P_t) ------(21)$$

Differentiating the log-likelihood function with respect to : β_2

$$\frac{\partial InL}{\partial \beta_2} = -\frac{1}{2\delta^2} \text{X} \frac{\partial \text{RSS}}{\partial \beta_2} \quad ------(22)$$

Substitute the result for $\frac{\text{RSS}}{\partial \beta_2}$:

$$\frac{\partial InL}{\partial \beta_2} = -\frac{1}{2\delta^2}[-2\sum_{t=1}^{n} E_t(y_t - \propto - \beta_1 E_t - \beta_2 P_t)] \; ------(23)$$

Simplify:

$$\frac{\partial InL}{\partial \beta_2} = \frac{1}{\delta^2}\sum_{t=1}^{n} P_t(y_t - \propto - \beta_1 E_t - \beta_2 P_t) \; ------(24)$$

Set equal to zero:

$$\sum_{t=1}^{n} P_t(y_t - \propto - \beta_1 E_t - \beta_2 P_t) = 0 \; ------(25)$$

Derivative with respect to δ^2

From the log-likelihood function:

$$InL = -\frac{n}{2}In(2\pi) - \frac{n}{2}In(\delta^2) - \frac{RSS}{2\delta^2} \quad ------(26)$$

Differentiate with respect to δ^2:

$$\frac{\partial InL}{\partial \delta^2} = -\frac{n}{2\delta^2} + \frac{RSS}{(2\delta^2)^2} \quad ------(27)$$

Set equal to zero:

$$-\frac{n}{2\delta^2} + \frac{RSS}{(2\delta^2)^2} = 0 \qquad ------(28)$$

Multiply through by $2(\delta^2)^2$

$$-n\delta^2 + RSS = 0 \qquad ------(29)$$

Hence:

$$\widehat{\delta^2} = \frac{RSS}{n} \qquad ------(30)$$

This is the MLE for the variance of the error term.

Standard Errors and Hypothesis testing:

The variances of the estimated coefficients are:

$$Var(\widehat{\beta_1}) = \delta^2\left(\frac{1}{n_E} + \frac{1}{n_N}\right) \qquad -------(31)$$

$$Var(\widehat{\beta_2}) = \delta^2\left(\frac{1}{n_P} + \frac{1}{n_N}\right) \qquad -------(32)$$

Taking the square root of each, result to the standard errors

$$SE(\widehat{\beta_1}) = \sqrt{\delta^2\left(\frac{1}{n_E} + \frac{1}{n_N}\right)} \qquad -------(33)$$

$$SE(\widehat{\beta_2}) = \sqrt{\delta^2\left(\frac{1}{n_P} + \frac{1}{n_N}\right)} \qquad -------(34)$$

The standard error stands for the degree of uncertainty in the estimated coefficients.

Formulation of Hypotheses

To test the significance of the parameters, the following null and alternative hypotheses are stated for each political event variable.

For the election-year dummy variable (E_t)

$H_0 : \beta_1 = 0$ (election years have significant effect on the economic indicator)

$H_1 : \beta_2 \neq 0$ (election years have no significant effect on the economic indicator)

For the policy reform dummy variable (P_t)

$H_0 : \beta_2 = 0$ (policy reform have significant effect on the economic indicator)

$H_1 : \beta_2 \neq 0$ (policy reform have no significant effect on the indicator).

Level of Significance:

All hypothesis tests in this study are carried out at the 5% level of significance ($\propto = 0.05$).

This means that there is a 5% probability of rejecting a true null hypothesis (Type 1 error).

Decision Rule.

After estimating the model coefficients using the Maximum Likelihood Estimation (MLE) techniques, the $t - statistics$ for each parameter are computed as follows:

$$t_1 = \frac{\widehat{\beta_1}}{SE(\widehat{\beta_1})} \qquad ------- (35)$$

$$t_2 = \frac{\widehat{\beta_2}}{SE(\widehat{\beta_2})} \qquad ------- (36)$$

After that, the computed $t - values$ are compared with the critical $t - value$ at the 5% significant level (approximately ± 2.07 for large samples)

If $ItI < 2.07$: Reject H_0 and conclude that the political event (election or policy reform) has a significant effect

If $ItI > 2.07$: Do not reject H_0, hence we conclude that the event has no significant effect.

DATA PRESENTATION

GDP Growth Rate

Table 1: GDP Growth Rates for Election years (y_E)

Year	GDP Growth (%) y	$(y - \bar{y}_E)$	$(y - \bar{y}_E)^2$
1999	0.7	-3.59	12.89
2003	9.50	5.21	27.14
2007	7.3	3.01	9.06
2011	4.9	0.61	0.37
2015	2.7	-1.59	2.53
2019	2.2	-2.09	4.37
2023	2.74	-1.55	2.40
TOTAL	30.03		58.76

Data source: National Bureau of Statistics (2024)

Table 2: GDP Growth Rates for Non Election years (y_N)

Year	GDP Growth (%) y	$(y - \bar{y}_E)$	$(y - \bar{y}_E)^2$
2000	5.5	-0.06	0.0036
2001	6.7	1.14	1.2996
2002	14.6	9.04	81.72
2004	10.6	5.04	25.40
2005	7.0	1.44	2.07
2006	6.7	1.14	1.2996
2008	7.2	1.64	2.69
2009	8.4	2.84	8.07
2010	11.3	5.74	32.95
2012	4.3	-1.26	1.59
2013	5.4	-0.16	0.026
2014	6.3	0.74	0.55
2016	-1.6	-7.16	51.27
2017	0.8	-4.76	22.66
2018	1.9	-3.66	13.40
2020	-1.8	-7.36	54.20
2021	3.6	-1.96	3.84
2022	3.3	-2.26	5.11
TOTAL	100.1		308.15

Data source: National Bureau of Statistics (2024)

Table 3: GDP Growth Rates for Policy Reform years (y_P)

Year	GDP Growth(%) y	$(y-\bar{y}_P)$	$(y-\bar{y}_P)^2$
2004	10.4	6.19	38.32
2010	11.3	7.09	50.27
2016	-1.6	-5.81	33.76
2020	-1.8	-6.01	36.12
2023	2.74	-1.47	2.16
TOTAL	21.04		160.63

Data source: National Bureau of Statistics (2024)

$From\ equ(2)$ $\quad \bar{y}_N = 5.56,\ \ \bar{y}_E = 4.29, \bar{y}_P = 4.21$

$\hat{\alpha}_{GDP} = 5.56$

$\hat{\beta}_{1GDP} = 4.29 - 5.56$

$\hat{\beta}_{1GDP} = -1.27$

$\hat{\beta}_{2GDP} = 4.21 - 5.56$

$\hat{\beta}_{2GDP} = -1.35$

$From\ equ(1)$ $\quad GDP_t = 5.56 - 1.27E_t - 1.35P_t$

$From\ equ(6)$ $\quad RSS_{GDP} = 527.54$

$From\ equ(30)$ $\quad \delta^2_{GDP} = \frac{527.54}{25}$

$\delta^2_{GDP} = 21.1$

$From\ equ(33)$ $\quad SE(\beta_{1GDP}) = \sqrt{21.1\left(\frac{1}{7} + \frac{1}{18}\right)}$

$SE(\beta_{1GDP}) = 2.05$

$From\ equ(34)$ $$SE(\beta_{2GDP}) = \sqrt{21.1\left(\frac{1}{5} + \frac{1}{18}\right)}$$

$$SE(\beta_{2GDP}) = 2.32$$

$From\ equ(35)$ $$t_{1GDP} = \frac{-1.27}{2.05}$$

$$t_{1GPD} = -0.62$$

$From\ equ(36)$ $$t_{2GDP} = \frac{-1.35}{2.32}$$

$$t_{2GDP} = -0.59$$

$From\ equ(7)$ $$InL = -\frac{25}{2}In\left(2\ x\ \frac{22}{7}\right) - \frac{25}{2}In(21.1) - \frac{527.54}{2(21.1)}$$

$$InL = -73.595$$

Hypotheses 1 Test:

$H_0 : \beta_{1GDP} = 0$ ($Elections\ \ have\ significant\ effect\ on\ GDP$)

$H_1 : \beta_{1GDP} \neq 0$ ($Elections\ \ have\ no\ significant\ effect\ on\ GDP$)

$H_0 : \beta_{2GDP} = 0$ ($Policy\ reforms\ have\ significant\ effect\ on\ GDP$)

$H_1 : \beta_{2GDP} \neq 0$ ($Policy\ reforms\ have\ no\ significant\ effect\ on\ GDP$)

Degree of freedom: $df = 25 - 3 = 22$

Critical t ($\propto = 0.05, two - tailed) = \pm 2.07$

Since It_{1GPD}I = 0.62 < 2.07, we reject H_0

Hence, elections have significant effect on GDP growth**.**

$$\text{Since } |t_{2GPD}| = 0.58 < 2.07, \text{we reject } H_0$$

Hence, policy reforms have significant effect on GDP growth**.**

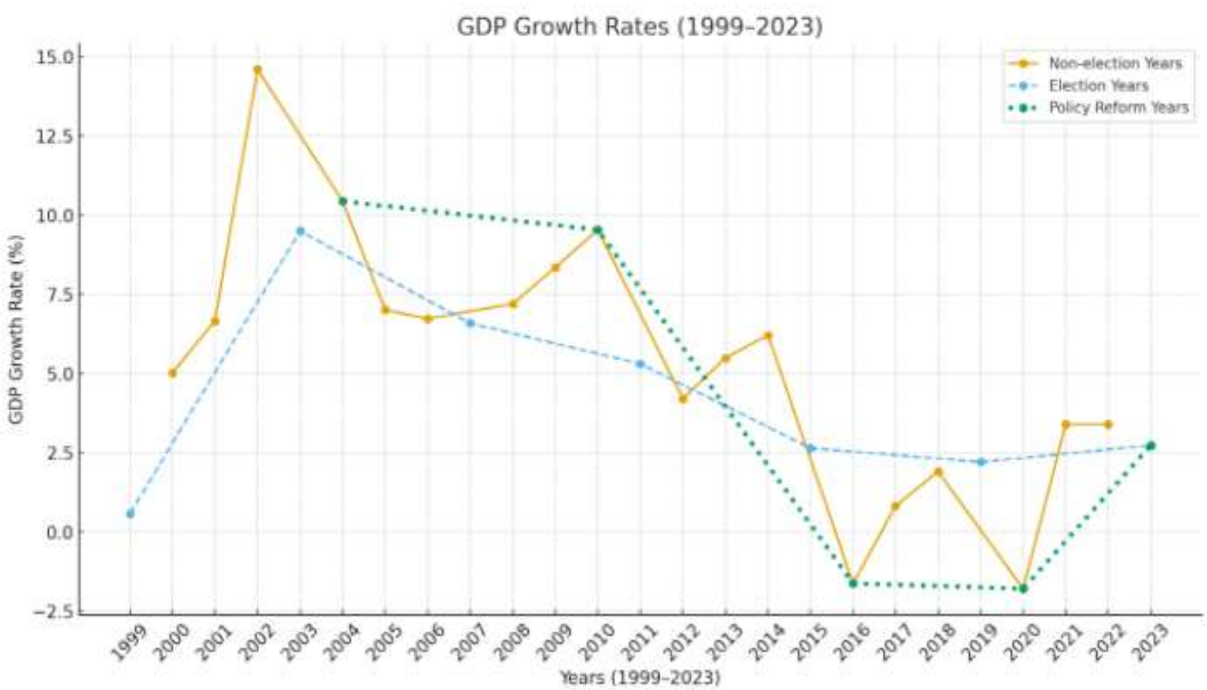

Figure 1 shows the GDP growth rate from 1999 to 2023

UNEMPLOYMENT GROWTH RATE

Table 4: Unemployment Growth Rates for Election years (Annual %)(y_E)

Year	Unemployment Rate(%)	$(y-\bar{y}_E)$	$(y-\bar{y}_E)^2$
1999	4.0	-0.11	0.012
2003	3.7	-0.41	0.17
2007	3.8	-0.31	0.096
2011	3.8	-0.31	0.096
2015	4.1	-0.01	0.0004
2019	5.2	1.09	1.19
2023	4.2	0.09	0.0081
TOTAL	28.8		1.573

Data source: National Bureau of Statistics (2024)

Table 5: Unemployment Growth Rates for Non Election years (Annual %) (y_N)

Year	Unemployment Rate (%)y	$(y-\bar{y}_N)$	$(y-\bar{y}_N)^2$
2000	3.9	-0.36	0.13
2001	3.9	-0.36	0.13
2002	3.7	-0.56	0.31
2004	3.6	-0.66	0.44
2005	3.7	-0.56	0.31
2006	3.8	-0.46	0.212
2008	3.8	-0.46	0.212
2009	3.8	-0.46	0.212
2010	3.8	-0.46	0.212
2012	3.8	-0.46	0.212
2013	3.7	-0.56	0.31
2014	3.9	-0.36	0.13
2016	4.5	0.24	0.058
2017	4.8	0.54	0.292
2018	5.1	0.84	0.71
2020	5.7	1.44	2.07
2021	5.5	1.24	1.54
2022	5.3	1.04	1.082
TOTAL	76.32		8.572

Data source: National Bureau of Statistics (2024)

Table 6: Unemployment Rates for Policy Reform years (Annual %) (y_P)

Year	Unemployment Rate (%)y	$(y-\bar{y}_P)$	$(y-\bar{y}_P)^2$
2004	3.6	-0.76	0.58
2010	3.8	-0.56	0.31
2016	4.5	0.14	0.02
2020	5.7	1.34	1.80
2023	4.2	-0.16	0.03
TOTAL	21.8		2.74

Data source: National Bureau of Statistics (2024)

$From\ equ\ (2)$ $\bar{y}_N = 4.24, \bar{y}_E = 4.11, \bar{y}_P = 4.36$

$$\hat{\alpha}_{UNE} = 4.24$$

$$\hat{\beta}_{1UNE} = 4.11 - 4.24$$

$$\hat{\beta}_{1UNE} = -0.13$$

$$\hat{\beta}_{2UNE} = 4.36 - 4.24$$

$$\hat{\beta}_{2UNE} = 0.12$$

$From\ equ\ (1)$ $$UNE_t = 4.24 - 0.13E_t + 0.12P_t$$

$From\ equ\ (6)$ $$RSS_{UNE} = 12.89$$

$From\ equ\ (30)$ $$\delta^2_{UNE} = \frac{12.89}{25}$$

$$\delta^2_{UNE} = 0.52$$

$From\ equ\ (33)$ $$SE(\beta_{1UNE}) = \sqrt{0.52\left(\frac{1}{7} + \frac{1}{18}\right)}$$

$$SE(\beta_{1UNE}) = 0.32$$

$From\ equ\ (34)$ $$SE(\beta_{2UNE}) = \sqrt{0.52\left(\frac{1}{5} + \frac{1}{18}\right)}$$

$$SE(\beta_{2UNE}) = 0.37$$

$From\ equ\ (35)$ $$t_{1UNE} = \frac{-0.13}{0.32}$$

$$t_{1UNE} = -0.41$$

$From\ equ\ (36)$ $$t_{2UNE} = \frac{0.12}{0.37}$$

$$t_{2UNE} = 0.33$$

$From\ equ\ (7)$ $$InL = -\frac{25}{2}In\left(2\ x\ \frac{22}{7}\right) - \frac{25}{2}In(0.52) - \frac{5.0477}{2(0.52)}$$

$$InL = -27.19$$

Hypotheses 2 Test:

$H_0: \beta_{1UNE} = 0$(Elections have significant effect on Unemployment rate)

$H_1: \beta_{1UNE} \neq 0$(Elections have no significant effect on Unemployment rate)

$H_0: \beta_{2UNE} = 0$ (Policy reforms have significant effect on Unemployment rate)

$H_1: \beta_{2UNE} \neq 0$ (Policy reforms have no significant effect on Unemployment rate)

Degree of freedom: $df = 25 - 3 = 22$

Critical t ($\propto = 0.05, two - tailed) = \pm 2.07$

Since It_{1UNE}I = 0.41 < 2.07**,** we reject H_0

Hence, election years have significant effect on Unemployment rate.

Since It_{2UNE}I = 0.33 < 2.07, we reject H_0

Hence, policy reforms years have significant effect on Unemployment.

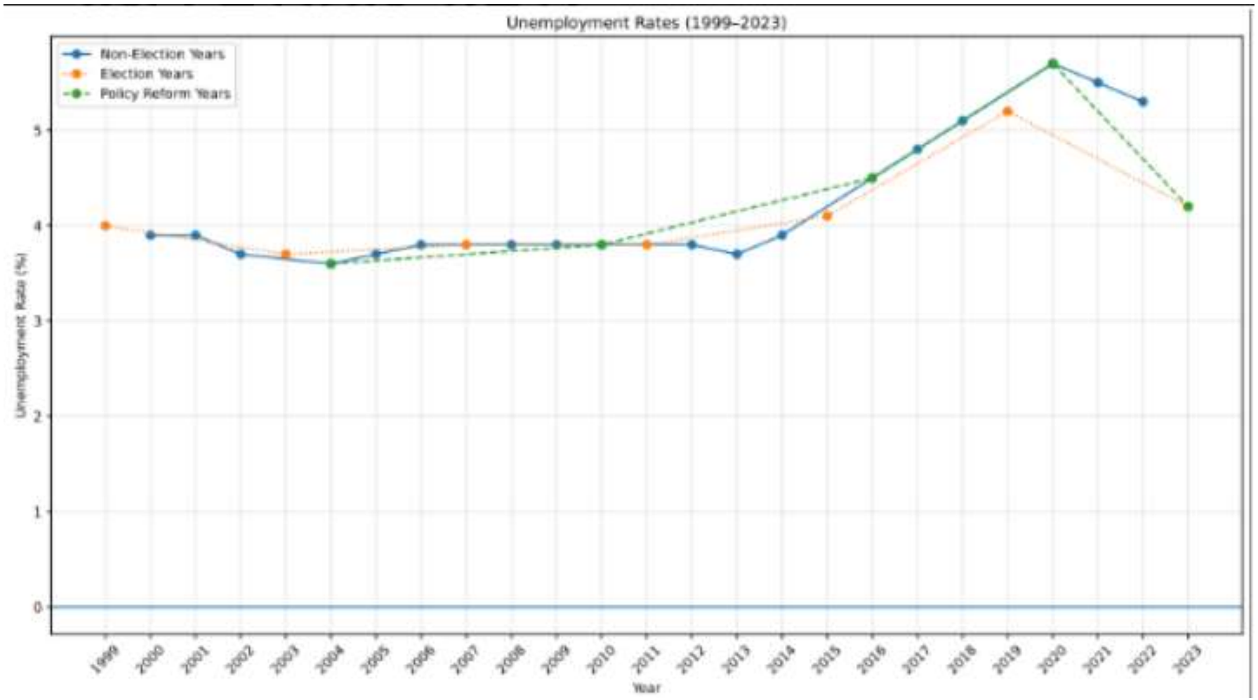

Figure.2: The unemployment rate from 1999 to 2023

Inflation Rate

Table 7: Inflation Rates for Election years (Annual %)(y_E)

Year	Inflation Rates (%)y	$(y-\bar{y}_E)$	$(y-\bar{y}_E)^2$
1999	6.6	-5.7	32.49
2003	14.0	1.7	2.89
2007	5.4	-6.9	47.61
2011	10.8	-1.5	2.25
2015	9.0	-3.3	10.89
2019	11.4	-0.9	0.81
2023	28.9	16.6	275.56
Total	86.1		372.5

Data source: National Bureau of Statistics (2024)

Table 8: Inflation Rates for Non Election years (Annual %)y_N

Year	Inflation (%)y_i	$(y-\bar{y}_N)$	$(y-\bar{y}_N)^2$
2000	6.90	-6.56	43.03
2001	18.90	5.44	29.59
2002	12.90	-0.56	0.31
2004	15.00	1.54	2.37
2005	17.90	4.44	19.71
2006	8.20	-5.26	27.67
2008	11.60	-1.86	3.46
2009	12.50	-0.96	0.92
2010	13.25	0.24	0.058

2012	12.20	-1.26	1.59
2013	8.50	-4.96	24.60
2014	8.10	-5.36	28.73
2016	15.70	2.24	5.02
2017	16.5	3.04	9.24
2018	12.10	-1.36	1.85
2020	13.25	-0.16	0.026
2021	17.0	3.54	12.53
2022	21.3	7.84	61.47
Total	234.45		272.174

Data source: National Bureau of Statistics (2024)

Table 9: Policy Reform year (Annual %)(y_P)

Year	Policy Reform (%)y	$(y - \bar{y}_P)$	$(y - \bar{y}_P)^2$
2004	15.0	-2.32	5.38
2010	13.7	-3.62	13.10
2016	15.7	-1.62	2.62
2020	13.3	-4.02	16.16
2023	28.9	11.58	134.1
Total	86.6		171.36

Data source: National Bureau of Statistics (2024)

$From\ equ\ (2)$ $\quad \bar{y}_N = 13.46\ , \bar{y}_E = 12.3,\ \bar{y}_P = 17$

$\hat{\alpha}_{INF} = 13.46$

$\hat{\beta}_{1INF} = 12.3 - 13.46$

$\hat{\beta}_{1INF} = -1.16$

$\hat{\beta}_{2INF} = 17.32 - 13.46$

$\hat{\beta}_{2INF} = 3.86$

$From\ equ\ (1)$ $\quad INF_t = 13.46 - 1.16E_t + 3.86P_t$

$From\ equ\ (6)$ $\quad RSS_{INF} = 816.03$

$From\ equ\ (30)$ $\quad \delta^2_{INF} = \frac{816.034}{25}$

$\delta^2_{INF} = 32.64$

$From\ equ\ (33)$ $\quad SE(\beta_{1INF}) = \sqrt{32.64\left(\frac{1}{7} + \frac{1}{18}\right)}$

$SE(\beta_{1INF}) = 2.5$

$From\ equ\ (34)$ $\quad SE(\beta_{2INF}) = \sqrt{32.64\left(\frac{1}{5} + \frac{1}{18}\right)}$

$SE(\beta_{2INF}) = 2.89$

$From\ equ\ (35)$ $\quad t_{1INF} = \frac{-1.16}{2.5}$

$t_{1INF} = -0.464$

$From\ equ\ (36)$ $\quad t_{2INF} = \frac{3.86}{2.89}$

t_{2INF} = 1.335

From equ (7) $$InL = -\frac{25}{2} In\left(2 \times \frac{22}{7}\right) - \frac{25}{2} In(32.64) - \frac{816.034}{2(32.64)}$$

$InL = -79.05$

Hypotheses 3 Test:

$H_0 : \beta_{1UNE} = 0$ (Elections have significant effect on Inflation rate)

$H_1 : \beta_{1UNE} \neq 0$(Elections have no significant effect on Inflation rate)

$H_0 : \beta_{2UNE} = 0$ (Policy reforms have significant effect on Inflation rate)

$H_1 : \beta_{2UNE} \neq 0$ **(**Policy reforms have no significant effect on Inflation rate)

Degree of freedom: $df = 25 - 3 = 22$

Critical t ($\propto = 0.05, two - tailed) = \pm 2.07$

Since It_{1INF}I = 0.464 < 2.07**,** we reject H_0

Hence, election years have a significant effect on Inflation rate.

Since It_{2INF}I = 1.335 < 2.07, we reject H_0

Hence, policy reforms have a significant effect on Inflation rate.

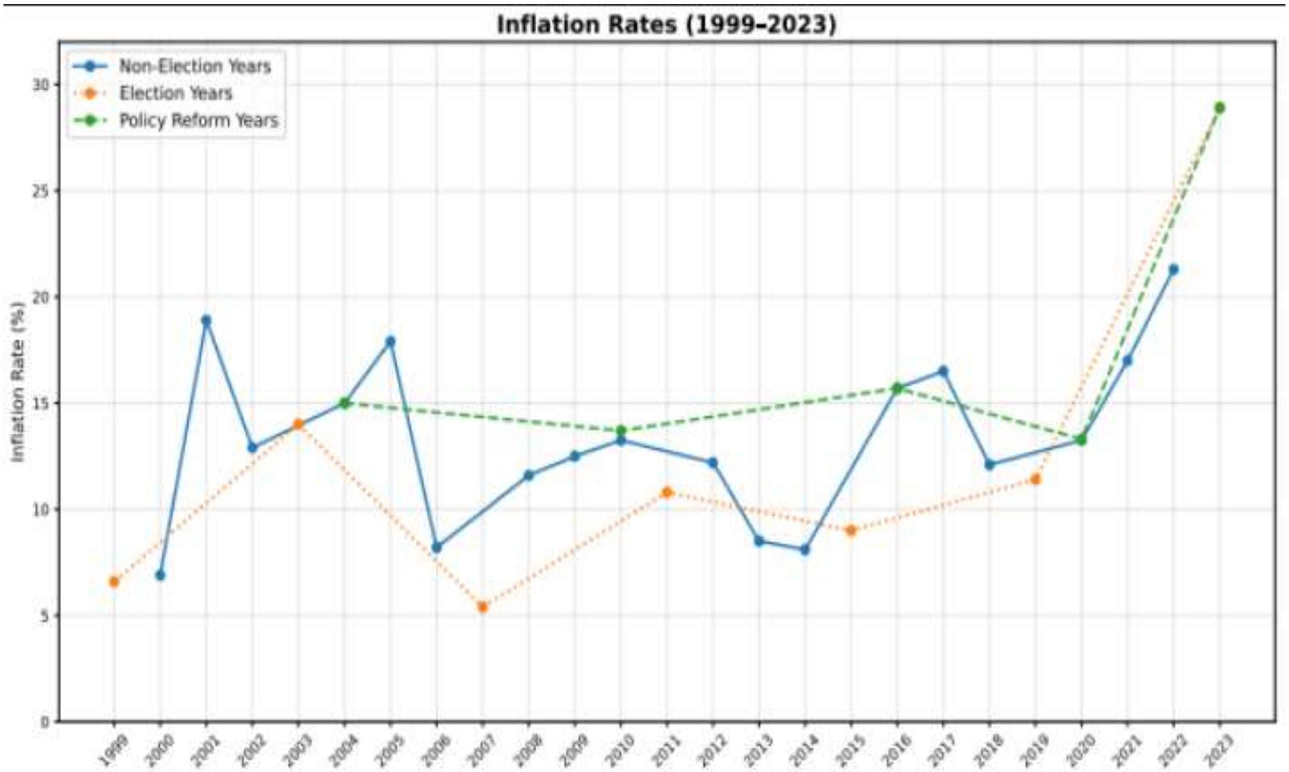

Figure 3.3: The inflation rate from 1999 to 2023

RESULTS AND DISCUSSION

The Maximum Likelihood Estimation (MLE) models were applied to analyze the impact of presidential elections in Nigeria from 1999 to 2023 on three key macroeconomic indicators: GDP growth rate, unemployment rate, and inflation rate. Political events were categorized as presidential election years, non-election years, and policy reform years. The estimated means, variances, and log-likelihood values reveal measurable effects of political events on all three indicators. GDP growth averaged 4.29%, 5.56%, and 4.20% for election years, non-election years, and policy reform years, respectively, with variance 21.1 and log-likelihood (InL) –73.595. Unemployment rates averaged 4.11%, 4.24%, and 4.36% (variance 0.52; InL –27.19), while inflation rates averaged 12.3%, 13.46%, and 17.32% (variance 32.64; InL –79.05). All t-statistics were significant, confirming that political events significantly influence macroeconomic outcomes.

The results indicate that presidential election cycles generate systematic disturbances in Nigeria's economy. Inflation shows the highest sensitivity to political uncertainty, consistent with findings by Sim (2021) and Greene (2018) who observed inflationary pressures during election periods. GDP growth exhibits moderate responsiveness, reflecting cyclical changes in government spending and private investment, as also noted by (Nikzad 2021). Unemployment shows minimal sensitivity, suggesting that labor market adjustments occur more gradually, in line with (Rain and Bamiro 2025).

The log-likelihood values demonstrate that the MLE models effectively capture the stochastic behavior of each indicator under different political conditions. The significance of all t-values indicates that these relationships are unlikely due to chance, supporting the hypothesis that presidential elections materially affect macroeconomic stability. By comparing three indicators within a unified probabilistic framework, this study extends prior research and provides quantitative insight into the relative impact of presidential election cycles on Nigeria's economic Predictive performance (Esokpor and Igabari, (2026); Bishop (2006).

Recent Solow-model-based analyses also show that structural factors interact with political and policy shocks to determine growth indices (Nwabenu, *et al* 2025), which supports our findings that GDP, inflation, and unemployment respond probabilistically rather than deterministically. The MLE framework distinguishes systematic political effects from random fluctuations and demonstrates its utility as a mathematically rigorous probabilistic tool for policy forecasting and economic planning in dynamic political environments.

Overall, the results highlight that presidential elections from 1999 to 2023 increase macroeconomic volatility, particularly in inflation, and confirm that MLE is a suitable tool for modeling the probabilistic effects of political events on economic indicators, providing policymakers with a robust framework for forecasting and intervention planning around election periods.

CONCLUSION

This study analyzed the impact of political events on GDP growth, unemployment, and inflation in Nigeria using Maximum Likelihood Estimation (MLE) for the period 1999–2023. The results showed that political events significantly affect all three indicators, with inflation being most sensitive, GDP growth moderately affected, and unemployment least responsive. The significant t-statistics and log-likelihood values confirm that these effects are statistically meaningful and not random. The study demonstrates that MLE—an established and widely applied method—effectively captures stochastic economic responses, filling a methodological gap in joint probabilistic analysis of macroeconomic indicators. The findings provide actionable insights for policymakers, who can adopt stochastic and likelihood-based models to anticipate and mitigate the effects of political uncertainty on economic performance.

RECOMMENDATION

1. Government agencies such as the Central Bank of Nigeria and National Bureau of Statistics should use mathematical models such as Maximum Likelihood Estimation to study the economic effects of political events.
2. Policymakers in Nigeria should maintain political stability and consistent economic policies to reduce uncertainty in economic indicators.
3. Economic planners should apply stochastic and probabilistic models when designing macroeconomic policies.

4. Future research should use more advanced stochastic models to better understand political–economic relationships.

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