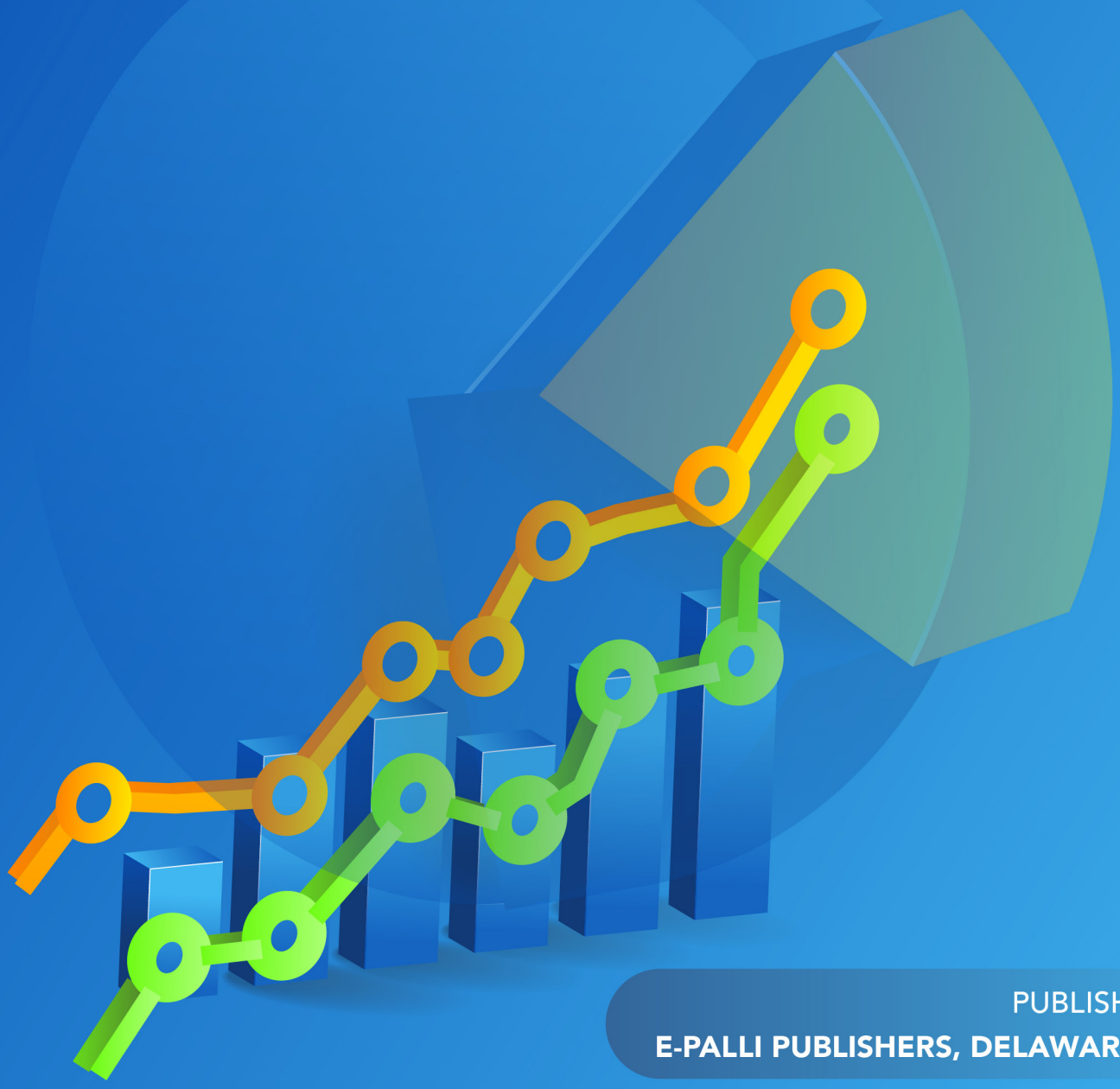
American Journal of Applied Statistics and Economics (AJASE)

ISSN: 2992-927X (ONLINE)

VOLUME 4 ISSUE 1 (2025)



PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Applied Statistics and Economics (AJASE)

Volume 4 Issue 1, Year 2025
ISSN: 2992-927X (Online)
DOI: https://doi.org/10.54536/ajase.v4i1.5833
https://journals.e-palli.com/home/index.php/ajase

Impact of Macroeconomic Factors on Government Spending in Ghana

Tobias Kwame Adukpo[1*], Jacob Obeng Bethel[2]

Article Information

Received: July 30, 2025

Accepted: September 01, 2025

Published: October 09, 2025

Keywords

Bayesian Analysis, Economic Indicators, Economic Modeling, Fiscal Policy, Government Spending, Macroeconomic Factors, Public Expenditure

ABSTRACT

This study examines how key macroeconomic variables such as GDP growth, inflation, interest rates, government debt and unemployment influence government spending in Ghana. While many studies rely on traditional econometric models, this research applies a Bayesian regression framework, which allows for the incorporation of prior information and a clearer assessment of uncertainty in the estimates. The results show that GDP growth, public debt and unemployment are positively associated with government spending, while higher interest rates constrain fiscal expenditure. The effect of inflation remains uncertain. These findings provide new evidence on the dynamics of fiscal behavior in Ghana and highlight the need for policymakers to balance growth and debt considerations while managing the risks of rising interest rates. The study contributes to the broader debate on how macroeconomic conditions shape fiscal policy in emerging economies.

INTRODUCTION

Economic policy is significantly supported by the presence of government spending as it carries a lot of influence in the progress of any given country (Stiglitz & Rosengard, 2015). For a nation like Ghana, which is actively striving to have a strong and inclusive growth, understanding the factors that influence government expenditure is not just academic research but an important investigation in achieving proper fiscal management and long-term financial sustainability. Ghana has had a long-documented history of having to deal with a complex set of fiscal challenges, such as the constant budget deficits, rising public borrowing and the fine juggling act of finding the means to fund development projects against available revenue (Asiama *et al.,* 2014). These challenges show the persistent instability in Ghana's fiscal space, which makes the dynamics of governmental expenditures an important topic to study.

Although traditional econometric analyses help determine economic relationships, sometimes these analyses are not comprehensive enough in grasping the complexity and uncertainties that exist in the fiscal policy of a developing economy. These constraints include limitations in integrating previous theoretical information, working with relatively medium sample sizes and the extensive probabilistic interpretation of parameter estimations (Koop & Korobilis, 2010). This article fills these gaps by depending on a Bayesian econometric approach to examine the impacts of macroeconomic factors on government spending in Ghana. The Bayesian framework has distinct benefits: it gives the ability to explicitly incorporate prior information and economic theory, provides a richer understanding of parameter uncertainty by summarizing information in full posterior distributions and it is especially resilient in situations when the quantity or quality of data is relatively sparse, or when some structural changes occur (An & Schorfheide, 2007).

The primary objective of this research was to understand the complex relationships that exist between the most significant macroeconomic indicators, such as real GDP, inflation rate, exchange rates, interest rates, public debt levels and unemployment levels on the dynamics of government spending in Ghana. Through a more stringent Bayesian approach, we presented a more informed and probabilistically oriented assessment regarding how these macroeconomic processes influence the fiscal decision process and outcomes in Ghana. The insight drawn from this examination is essential to policymakers in Ghana and helps develop better, more robust and responsive fiscal policies, which improve the way the state handles finances and eventually this change will help steer Ghana to a scenario of long-term economic success, regardless of the changes in the global and local economy. The study is part of the large body of literature regarding fiscal policy in developing economies and provides a methodological framework that other researchers can use in a similar setting.

[1] Department of Accounting, University for Development Studies, Ghana
[2] Department of Economics, University of Ghana, Ghana
[*] Corresponding author's e-mail: adukpotobias@gmail.com

LITERATURE REVIEW

Understanding Government Spending

Government spending, also known as public expenditure, refers to the spending made by a government to finance its operations and functions (Stiglitz & Rosengard, 2015). It includes current consumption expenditure for daily operations and public servant salaries, capital investments aimed at long-term asset creation like infrastructure for social welfare programs and income redistribution and crucially, interest payments on government borrowing (Musgrave & Musgrave, 1980). These expenditures serve as vital tools of fiscal policy that directly influence macroeconomic variables such as aggregate demand, economic growth and employment (Keynes, 1937; Barro, 1990; Afonso & Furceri, 2010). In developing countries like Ghana, government expenditure is of much concern, since it supports the establishment of necessary public services, fosters the creation of supportive infrastructure and enables the establishment of social protection networks. Consequently, a comprehensive understanding of its dynamics is of paramount importance for effective economic governance and the achievement of national development goals.

Theoretical Foundations of Government Spending

Wagner's Law (Law of Increasing State Activity)

This hypothesis was proposed by Adolph Wagner in the late 1800s and has been the subject of several studies. The hypothesis suggests that as economic development indicators such as rising per capita income, industrialization and public sector expansion improve, government expenditure is also expected to increase correspondingly. With a rise in the number of nations that are getting richer, there is a growing need for public goods and services (education, healthcare, and infrastructure, etc.), as well as the nature of administrative and legal operations, which have also seen government expenditures rise (Wagner, 1883). In some regions around the world, not everyone has supported this theoretical evidence, although some studies conducted in Ghana have supported the use of this law, which implies that the growth of the economy results in higher levels of government spending in the Ghanaian economy (Keho, 2016).

Peacock-Wiseman Hypothesis (Displacement Effect)

Contrary to the smooth rise that Wagner suggested, Peacock and Wiseman (1961) proposed that spending by governments does not rise progressively but in a sequential manner in jumps. The causes of these jumps are mostly social upheavals such as wars, natural disasters, or a major economic crisis. In times like these, those societies can live with increased taxation to fund higher government spending. After the crisis passes, increased government spending and taxation made during its high points are likely to continue, as people get accustomed to a greater governmental role and the new services the government provides. This displacement effect, in addition to an inspection effect (reassessment of acceptable levels of taxes by the people) and a concentration effect (central government increases its limits), results in a higher permanent plateau of government spending (Peacock & Wiseman, 1961; Ocran, 2011). The history of economic shocks and structural adjustment programs in Ghana proves an excellent testing arena for this hypothesis.

Keynesian Theory

In the Keynesian approach, government spending is considered an exogenous variable and a method of stabilizing the economy. The expansion in government expenditure increases aggregate demand when there is no growth and aggregate demand is at its lowest, particularly during a recession, by way of a multiplier effect, thus affecting economic development and employment (Keynes, 1937). It means that fiscal policy actively participates in economic cycle management, which proposes an idea of countercyclical spending to counterbalance the fluctuations in the private sector (IMF, 2014).

Empirical Review

The connection between government expenditure and macroeconomic measures has been studied extensively, with studies frequently using a diversity of econometric methods to ensure a variety of national economies (Gemmell et al, 2011; Gupta *et al.,* 2005). GDP growth has always been associated with government expenditure. To illustrate this, Afonso and Jalles (2016), in a panel VAR model of 28 EU countries, discovered that economic growth is usually accompanied by higher government expenditure, which implies procyclical fiscal behaviour in most of the EU member states. Similarly, Gali and Perotti (2003) used a structural VAR model across OECD countries, including Germany, France, the UK and the US, to argue that fiscal policies moderate toward the direction of expansion during economic booms as governments spend on government services and infrastructure. In Ghana, Mensah and Adukpo (2025) used a multiple regression model and found that capital expenditure is a significant determinant of economic growth, though recurrent expenditure increased economic growth positively but was not significant. These implications highlight the point that the growth in GDP leads to not only widened fiscal space but also a shift in policy inclinations that could be achieved by increasing investment on a larger scale in the public sector.

Inflation, on the other hand, has played a more complex role in government spending. High inflation erodes the real value of government budgets and complicates long-term fiscal planning. For instance, Lithuania *et al.* (2012), using VECM and Granger causality tests, established that inflation volatility contributed to fiscal uncertainty and constrained capital investment. Their study showed a negative correlation between inflation and developmental spending, particularly in liberal economies with high fiscal balance requirements. Similarly, Anagaw (2023),

emphasized that persistent inflation undermines macroeconomic stability, reduces long-term growth potential, disproportionately affects low-income and unemployed groups. These findings highlight how inflation not only depreciates the real value of government resources but also generates substantial distortions that hinder both fiscal planning and sustainable economic growth.

Interest rates also influence government spending since they influence the price of borrowing. High interest rates increase the burden of debt service payments, thereby reducing the fiscal space available for other crucial expenditures. In a case study conducted across 216 countries, Peña (2023) used system GMM and Granger causality analysis, revealing a strong negative correlation between interest rate and aggregate government expenditure. Their findings show that an increase in interest rates acts as a deterrent towards the borrowing of essential areas like infrastructure and education. The impact of this effect is especially high in developing economies, where the payment of interest displaces funds that should be used in social and economic programs.

Another crucial aspect that determines government expenditure is public debt. In a panel fixed-effects model and analysis of high-debt OECD countries like Italy, Greece, and Portugal, Alesina *et al.* (2019) found that rising public fund levels of a country tend to tighten its fiscal policies, most commonly through capital expenditure cuts. Backing this, the IMF (2015) indicated that a high level of public debt usually forces governments to transfer funds, which should have been used to develop the country, to pay the debt. These findings support the debt overhang hypothesis, that there exists debt or burden in the form of debt that can restrict governments from stimulating the economy by spending.

Unemployment also acts as a major determinant of fiscal policy. During periods of economic downturn, governments often increase spending on social protection programs to mitigate the impact of job losses. A time-varying VAR model based on U.S. data by Klein and Linnemann (2020) demonstrated that the increase in unemployment rates leads to an increase in spending by governments on social protection programs. Their finding demonstrates how automatic stabilizers, which include unemployment benefits, increase government spending during economic downturns at varying magnitudes at different points in time. Complementing this perspective, Nojeem (2020) employed an Auto Regressive Distributed Lag (ARDL) bounds testing approach to Nigerian data from 2010 to 2020. Their results identified an inverse relationship between unemployment and economic growth, with unemployment further associated with rising crime rates. All these findings emphasize both the countercyclical role of fiscal policy and the wider macroeconomic and social implications of persistent unemployment.

On the methodological side, Afonso and Sousa (2012) employed a Bayesian Structural VAR model based on data in the US, UK, Germany and Italy and their results indicated that fiscal shocks had a modest but persistent effect on GDP and private consumption. Such methods based on Bayesian conditioning have been preferred because of their capability to use prior knowledge and yield more consistent estimates, especially in complex and uncertain environments (Koop & Korobilis, 2010).

To conclude, the literature consistently attests that macroeconomic factors such as GDP growth, inflation, interest rates, public debt and unemployment play huge roles in determining the pattern of government spending. However, the magnitude and directions of such effects vary depending on the economy and the model employed. This study builds on this foundation by using a Bayesian multiple regression model and provides a more in-depth analysis of these relationships in Ghana. The Bayesian approach is advantageous in its capacity to ensure robust modelling, which is highly flexible because it combines prior information with explicit consideration of the parameters' uncertainty.

MATERIALS AND METHODS

This study employs a Bayesian multiple regression method to estimate the impact of the macroeconomic variables on government spending in Ghana. Bayesian methods are chosen based on their potential robustness in dealing with model uncertainty and incorporating prior information and their ability to produce full posterior distributions of the estimated parameters. Using this is especially favorable in macroeconomic cases when one of the main problems is data limitation and multicollinearity. The analysis was also based on secondary annual data covering the period from 2000 to 2024. The key variables included in this research were government spending, GDP growth, inflation, interest rates, public debt and unemployment rates. These data were sourced from institutions such as the Bank of Ghana (BoG), International Monetary Fund (IMF), Ghana Statistical Service (GSS) and the World Bank. These sources were selected for their credibility, consistency and relevance to Ghana's macroeconomic landscape. Additionally, all monetary figures were converted into real terms to neutralize inflationary effects, which ensures that our analysis captures genuine economic impacts.

Model Specification

The empirical model is defined as a linear regression in which the dependent variable is the government expenditure and the independent variables are GDP growth rate, inflation rate, interest rate, public debt and unemployment rate. The model is presented as:

$$GOVEXP_t = \beta_o + \beta_1 GDPGR_t + \beta_2 INF_t + \beta_3 INT_t + \beta_4 PUBDE_t + \beta_5 UNEMP_t + \varepsilon_t$$

Where,

$GOVEXP_t$ = Government expenditure at time t

$GDPGR_t$ = GDP growth rate at time t

INF_t = Inflation rate at time t
INT_t = Interest rate at time t
$PUBDE_t$ = Public debt at time t
$UNEMP_t$ = Unemployment rate at time t
β_o is the intercept
$\beta_1,\beta_2\ldots\beta_5$ are the coefficients for the explanatory variable
ε_t is the error term
The equation above can be written in matrix form as:
$y = X\beta+\epsilon$, the error term is assumed to follow a normal distribution (i.e. $\epsilon\sim N_n(0,\sigma^2 I)$),
$\beta=(\beta_0,\beta_1\ldots\beta_{k-1})^T$, is the n×k vector of parameters and $\epsilon=(\epsilon_1,\epsilon_2\ldots\epsilon_n)^T$ the n×1 vectors of errors.
In contrast, Bayesian regression involves prior beliefs or knowledge in the study by use of prior distributions as opposed to traditional frequentist regression, which merely uses observed data. In this study, non-informative priors were used to ensure that the data itself primarily influences the results, which allows for an unbiased estimation process. The likelihood function is assumed to be normally distributed, which aligns with standard regression assumptions. To determine the posterior distributions of the model parameters, the Markov Chain Monte Carlo (MCMC) method was used with a focus on the Gibbs sampling algorithm. This approach allows the problem of approximating complex posterior distributions with efficiency and credibility, mostly in situations where an analytical solution is not possible (Kruschke, 2018).

Estimation Technique

In Bayesian inference, the goal is to estimate the posterior distribution of the model parameters $\beta=(\beta_1,\beta_2\ldots\beta_k)$ and σ^2 conditional on the observed data. This study models the relationship between government spending and five key macroeconomic variables: GDP growth, inflation rate, interest rate, public debt and unemployment rate. The Bayesian estimation process involves three key steps: First, we define the prior distributions for each β. Given that we lack strong prior information about the exact magnitude of the effects for the β's, we used weakly informative priors. The prior distribution for each coefficient (β) is assumed to follow a normal distribution with mean m and variance V ($\beta\sim N(m,V)$) to allow flexibility.
The prior density function for each β is

$$f(\beta|\sigma^2,m,V)=\frac{1}{(2\pi\sigma^2V)^{\frac{1}{2}}}\exp\left\{-\frac{1}{2\sigma^2}(\beta-m)^TV^{-1}(\beta-m)\right\}$$

The prior distribution for σ^2 is also assumed to follow an inverse gamma distribution with hyperparameters a and b. The prior density function for σ^2 is:

$$f(\sigma^2|a,b)=\frac{b^a}{\Gamma(a)}(\sigma^2)^{a-1}\exp\left(-\frac{b}{\sigma^2}\right)$$

Secondly, we specify the likelihood distribution of the observed y. The likelihood function was derived based on the observed data and the assumed error distribution. The Likelihood of the joint density function of the observed y_i's is:

$$f_y(y|X,\beta,\sigma^2)=\prod_{i=1}^{n}\frac{1}{(2\pi\sigma^2)^{\frac{1}{2}}}\exp\left\{-\frac{1}{2\sigma^2}(y-X\beta)^T(y-X\beta)\right\}$$

$$f_y(y|X,\beta,\sigma^2)=\frac{1}{(2\pi\sigma^2)^{\frac{n}{2}}}\exp\left\{-\frac{1}{2\sigma^2}(y-X\beta)^T(y-X\beta)\right\}$$

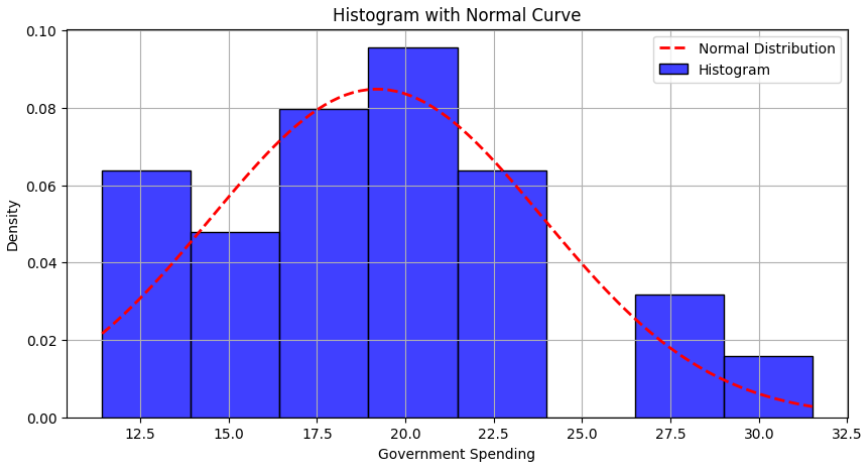


Figure 1: Histogram of Government spending with a normal curve

Because the purpose of the study is to find out how the macroeconomic indicators affect government spending trends, the histogram (figure 1 above) reveals that the data on government spending is approximately normally distributed, with a slight skew in the right direction. This is in support of the likelihood function of the Bayesian model, which implies that a Gaussian likelihood is suitable. The consistency between the data with the normal curve indicates a well-specified inference model.
Thirdly, using MCMC sampling techniques, the posterior distributions of the parameters (β's) are obtained, which allows for robust estimation and uncertainty quantification. The posterior density function for β and σ^2 were derived using the formula:

$$Posterior \propto Likelihood \times Prior$$

$$f(\beta,\sigma^2|y,x,m,V,a,b) = f_y(y|X,\beta,\sigma^2) \times f(\beta|\sigma^2,m,V) \times f(\sigma^2|a,b)$$

$$f(\beta,\sigma^2|y,x,m,V,a,b) = \frac{1}{(2\pi\sigma^2)^{\frac{n}{2}}}\exp\left\{-\frac{1}{2\sigma^2}(y-X\beta)^T(y-X\beta)\right\} \times \frac{1}{(2\pi\sigma^2V)^{\frac{k}{2}}}\exp\left\{-\frac{1}{2\sigma^2}(\beta-m)^TV^{-1}(\beta-m)\right\} \times \frac{b^a}{\Gamma(a)}(\sigma^2)^{a-1}\exp\left(-\frac{b}{\sigma^2}\right)$$

$$f(\beta,\sigma^2|y,x,m,V,a,b) = \frac{1}{(2\pi\sigma^2)^{\frac{n}{2}}} \times \frac{1}{(2\pi\sigma^2V)^{\frac{k}{2}}} \times \frac{b^a}{\Gamma(a)}(\sigma^2)^{a-1} \times \exp\left\{-\frac{1}{2\sigma^2}(y-X\beta)^T(y-X\beta)\right\} \times \exp\left\{-\frac{1}{2\sigma^2}(\beta-m)^TV^{-1}(\beta-m)\right\} \times \exp\left(-\frac{b}{\sigma^2}\right)$$

$$f(\beta,\sigma^2|y,x,m,V,a,b) = \frac{1}{(2\pi)^{\frac{n}{2}}} \times \frac{1}{(2\pi V)^{\frac{k}{2}}} \times \frac{b^a}{\Gamma(a)} \times (\sigma^2)^{-\frac{n}{2}-\frac{k}{2}+a-1} \times \exp\left\{-\frac{1}{2\sigma^2}(y-X\beta)^T(y-X\beta) - \frac{1}{2\sigma^2}(\beta-m)^TV^{-1}(\beta-m) - \frac{b}{\sigma^2}\right\}$$

Let $D = \frac{1}{(2\pi)^{\frac{n}{2}}} \times \frac{1}{(2\pi V)^{\frac{k}{2}}} \times \frac{b^a}{\Gamma(a)}$.

$$f(\beta,\sigma^2|y,x,m,V,a,b) = D \times (\sigma^2)^{-\frac{n}{2}-\frac{k}{2}+a-1} \times \exp\left\{-\frac{1}{2\sigma^2}(y^Ty - y^TX\beta - \beta^TX^Ty + \beta^TX^TX\beta + \beta^TV^{-1}\beta - \beta^TV^{-1}m - m^TV^{-1}\beta + m^TV^{-1}m + 2b)\right\}$$

$$f(\beta,\sigma^2|y,x,m,V,a,b) = D \times (\sigma^2)^{-\frac{n}{2}-\frac{k}{2}+a-1} \times \exp\left\{-\frac{1}{2\sigma^2}(y^Ty + m^TV^{-1}m + 2b - \beta^TX^Ty - \beta^TV^{-1}m - y^TX\beta - m^TV^{-1}\beta + \beta^TX^TX\beta + \beta^TV^{-1}\beta)\right\}$$

$$f(\beta,\sigma^2|y,x,m,V,a,b) = D \times (\sigma^2)^{-\frac{n}{2}-\frac{k}{2}+a-1} \times exp\left\{-\frac{1}{2\sigma^2}(y^Ty + m^TV^{-1}m + 2b) - \beta^T(X^Ty + V^{-1}m) - (y^TX + m^TV^{-1})\beta + \beta^T(X^TX + V^{-1})\beta\right\}$$

The posterior mean and variance for each parameter ($\beta's$) are given by:

$$\beta_n = \Sigma_n(\Sigma_0^{-1}\beta_0 + \frac{1}{\sigma^2}X^Ty)$$

$$\Sigma_n = (\Sigma_0^{-1} + \frac{1}{\sigma^2}X^Ty)^{-1}$$

Data Analysis and Discussions

This study employed a Bayesian multiple regression framework to examine how key macroeconomic variables, including GDP growth, inflation rate, interest rates, public debt and unemployment rate, affect government spending. Through the adoption of a Bayesian approach, the analysis does not capture the direction and strength of these relationships only but also provides a

Table 1: Posterior Estimates of the Bayesian Regression Model

Macroeconomic Indicators	Mean	SD	HDI 3%	HDI 97%	MCSE Mean	MCSE SD
Intercept	27.498	6.681	14.352	39.458	0.115	0.081
GDP growth	1.681	0.555	0.654	2.707	0.012	0.008
Inflation rate	0.300	0.184	-0.021	0.676	0.003	0.002
Interest rate	-1.797	0.399	-2.580	-1.071	0.009	0.006
Public debt	0.242	0.065	0.117	0.362	0.001	0.001
Unemployment rate	3.358	3.358	1.491	5.106	0.022	0.016
Sigma	4.518	0.669	3.188	5.700	0.015	0.010

Source: Authors' calculations

comprehensive understanding of the uncertainty around each estimate through full posterior distributions. The results, as presented in Table 1 (Posterior Means and HDIs) and Table 2 (MCMC Diagnostics), offer clear and probabilistically informed insights into how each factor contributes to shifts in government expenditure; however, the credible intervals reflect the confidence we place in those findings.

The intercept, which represents the estimated baseline level of government spending when all macroeconomic factors are held constant, was found to be 27.498, with a 94% Highest Density Interval (HDI) ranging from 14.352 to 39.458. This wide interval reflects a degree of uncertainty around the baseline level of expenditure. This is due to unobserved factors or structural shifts in fiscal policy over the study period. GDP growth exhibited a strong positive relationship with government spending. The posterior mean coefficient was 1.681, with a 94% HDI of (0.654 to 2.707), which suggests that a one-unit increase in GDP growth is associated with an approximate 1.68 unit increase in government spending. This finding aligns with Wagner's Law, where higher economic growth enhances revenue mobilization, enabling greater fiscal space for government expenditures.

Inflation demonstrated a marginal and uncertain effect. The posterior mean coefficient was 0.300, but the 94% HDI of (-0.021 to 0.676) includes zero. This indicates a potential lack of robust influence, which suggests that inflation has a neutral or slightly ambiguous effect on fiscal policy decisions, depending on prevailing monetary and price stabilization measures or through adaptive or nominal adjustments that insulate aggregate spending from direct inflationary shocks. Interest rates showed a significant inverse relationship with government spending. The posterior mean coefficient was -1.797, with a 94% HDI of (-2.580 to -1.071), which indicates that as interest rates increase, government spending tends to decrease. This is attributed to the rising cost of debt servicing and a contraction in fiscal space, which limits the government's capacity for discretionary spending.

Public debt had a positive and statistically significant effect on government spending, with a posterior mean of 0.242 and a 94% HDI of (0.117 to 0.362). This relationship suggests that increases in public debt, primarily through borrowing, enable governments to finance higher levels of expenditure. Borrowed funds are often directed toward capital investments, social programs or economic stimulus packages, especially in developing economies like Ghana, where revenue bases are limited. The unemployment rate displayed a strong and positive relationship with government spending. The posterior mean coefficient was 3.358, and the 94% HDI of (1.491 to 5.106) was entirely positive. This indicates that higher unemployment levels lead to greater government spending. This is likely due to increased allocations toward social protection, unemployment benefits, skills training initiatives and job creation initiatives aimed at mitigating social distress and stimulating economic activity.

Lastly, the posterior mean of sigma, which captures the standard deviation of the model's residuals, was 4.518, with a 94% HDI of (3.188 to 5.700). The Monte Carlo Standard Errors (MCSE) for all parameters were consistently low. This confirms adequate convergence of the Markov Chain Monte Carlo (MCMC) simulations and reliability of the estimated posterior distributions.

The convergence of the Markov Chain Monte Carlo (MCMC) chains was thoroughly assessed using R hat and Effective Sample Size (ESS) diagnostics. All R hat values were 1.0, indicating excellent convergence for all parameters. Though the ESS values, which ranged from 1892.0 to 3384.0 for ESS bulk and 2599.0 to 4084.0 for ESS tail, were generally satisfactory, slightly lower ESS bulk values were observed for interest rates and unemployment rates. However, the overall ESS values were deemed sufficient to ensure the reliability and robustness of the posterior estimates. This confirms that the MCMC procedure yielded well-converged and dependable parameter estimates.

Table 2: Posterior Estimates of the Bayesian Regression Model

	ESS bulk	**ESS tail**	**R hat**
Intercept	3384.0	4067.0	1.0
GDP growth	2191.0	3816.0	1.0
Inflation rate	2885.0	4084.0	1.0
Interest rate	1892.0	2788.0	1.0
Public debt	2795.0	3681.0	1.0
Unemployment rate	1932.0	2885.0	1.0
Sigma	2105.0	2599.0	1.0

Source: Authors' calculations

The convergence and reliability of the Bayesian regression were further assessed through visual inspection of the posterior distributions and trace plots (Figure 1). Consistent with the R hat values of 1.0, the trace plots for all parameters exhibited good mixing, which indicated successful convergence of the MCMC chains. The posterior distributions displayed in the left column of Figure 1 visually represent the uncertainty surrounding each parameter estimate. For instance, the posterior distribution for the interest rate was centered on a

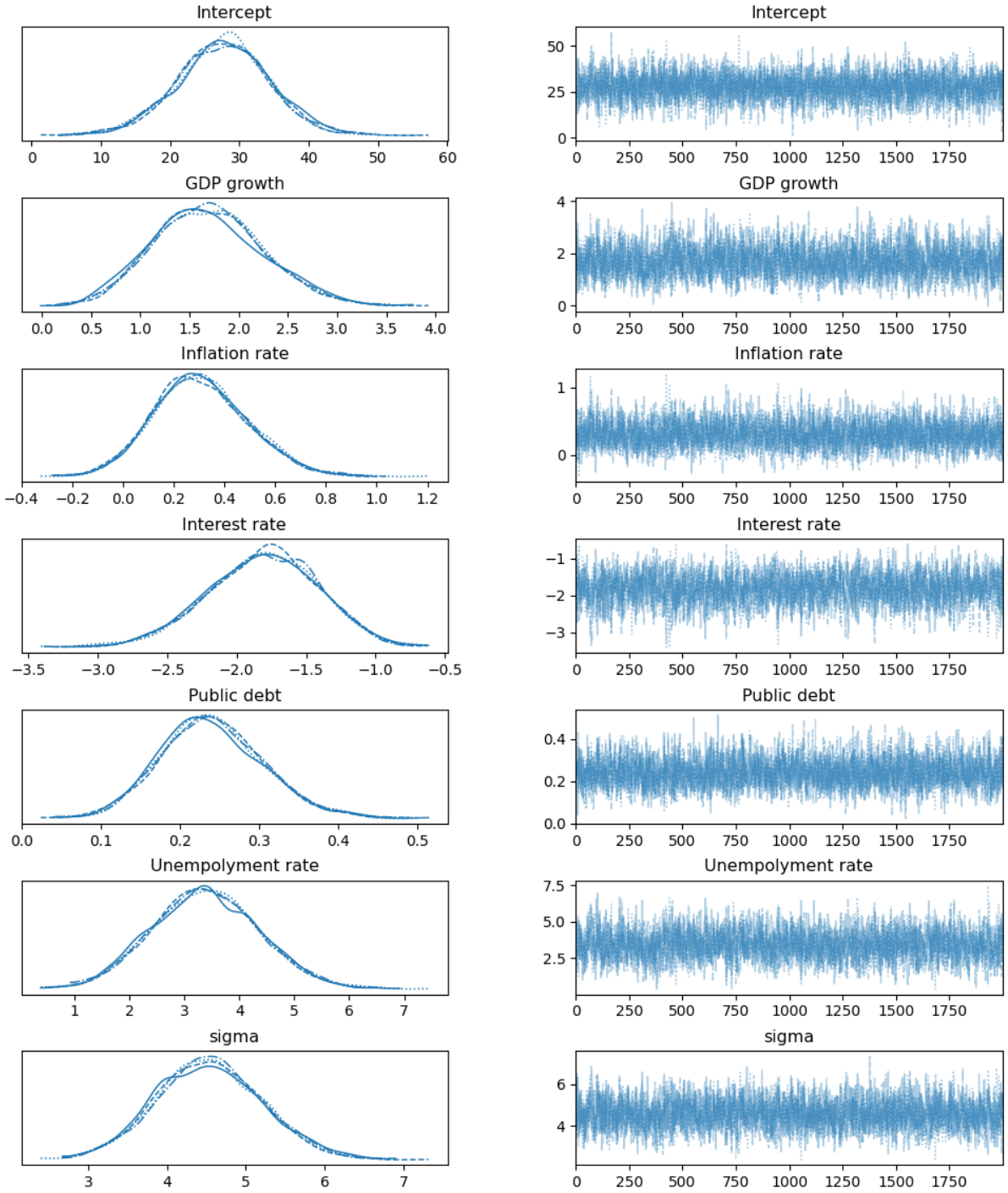


Figure 2:
Source: Authors' calculations

negative value, and this confirms the negative relationship observed in Table 1, with a mean of -1.797. Similarly, the positive relationships for GDP growth (mean 1.681), public debt (mean 0.242) and unemployment rate (mean 3.358) were reflected in the location of their respective posterior distributions. The wider distribution for the inflation rate, compared to other parameters, mirrored the greater uncertainty indicated by its wider 94% HDI (-0.021 to 0.676) in Table 1.

CONCLUSION

This research employs a Bayesian multiple regression framework to examine how key macroeconomic factors, including GDP growth, inflation, interest rates, public debt and unemployment influence government spending. The Bayesian approach allowed for the incorporation of prior knowledge and provided an insightful understanding by capturing the uncertainty surrounding each relationship through probability distributions. The analysis revealed several meaningful insights. GDP growth, public

debt and unemployment were found to have positive associations with government spending. This suggests that as the economy grows or faces higher unemployment, governments tend to increase their expenditure, either to sustain growth or cushion the social impact of job losses. The positive effect of public debt reflects the reality that governments often rely on borrowing to finance increased spending, especially during times of economic pressure or investment-driven policy goals. On the other hand, interest rates showed a strong negative relationship with government spending. This is consistent with economic theory that says that as higher interest rates raise the cost of borrowing, it can constrain fiscal space and reduce the incentive or ability of governments to expand spending. Inflation rate, however, presented an inconclusive relationship; its credible interval included zero, which indicates uncertainty about its true effect.

REFERENCES

Afonso, A., & Furceri, D. (2010). Government size, composition, volatility and economic growth. *European Journal of Political Economy, 26*(4), 517-532.

Afonso, A., & Jalles, J. T. (2016). The elusive character of fiscal sustainability. *Applied Economics, 48*(28), 2651-2664.

Afonso, A., & Sousa, R. M. (2012). The macroeconomic effects of fiscal policy. *Applied Economics, 44*(34), 4439-4454.

Alesina, A., Favero, C., & Giavazzi, F. (2019). Effects of austerity: Expenditure-and tax-based approaches. *Journal of Economic Perspectives, 33*(2), 141-162.

An, S., & Schorfheide, F. (2007). Bayesian analysis of DSGE models. *Econometric reviews, 26*(2-4), 113-172.

Anagaw, T. (2023). Review on: Effect of Inflation on Economic Growth in Ethiopia. *American Journal of Applied Statistics and Economics, 2*(1), 7–10.

Asiama, J., Akosah, N., & Owusu-Afriyie, E. (2014). *An assessment of fiscal sustainability in Ghana.* Bank of Ghana Research Working Paper, WP/BOG-2014/09. Accra: Bank of Ghana.

Barro, R. J. (1990). Government spending in a simple model of endogeneous growth. *Journal of political economy, 98*(5, Part 2), S103-S125.

Galí, J., & Perotti, R. (2003). Fiscal policy and monetary integration in Europe. *Economic policy, 18*(37), 533-572.

Gemmell, N., Kneller, R., & Sanz, I. (2011). The timing and persistence of fiscal policy impacts on growth: evidence from OECD countries. *The Economic Journal, 121*(550), F33-F58.

Gupta, S., Clements, B., Baldacci, E., & Mulas-Granados, C. (2005). Fiscal policy, expenditure composition, and growth in low-income countries. *Journal of International Money and Finance, 24*(3), 441-463.

International Monetary Fund. (2014, October 8). *Fiscal Monitor, October 2014: Back to work: How fiscal policy can help* (Fiscal Monitor No. 2014/002).

International Monetary Fund. (2015). *Fiscal Monitor: Now Is the Time – Fiscal Policies for Sustainable Growth* (April 2015).

Keho, Y. (2016). Testing Wagner's law in the presence of structural changes: New evidence from six African countries (1960-2013). *International Journal of Economics and Financial Issues, 6*(1), 1-6.

Keynes, J. M. (1937). The general theory of employment. *The quarterly journal of economics, 51*(2), 209-223.

Klein, M., & Linnemann, L. (2020). The time-varying effect of fiscal policy on inflation: Evidence from historical US data. *Economics Letters, 186*, 108823.

Kofi Ocran, M. (2011). Fiscal policy and economic growth in South Africa. *Journal of Economic Studies, 38*(5), 604-618.

Koop, G., & Korobilis, D. (2010). Bayesian multivariate time series methods for empirical macroeconomics. *Foundations and Trends® in Econometrics, 3*(4), 267-358.

Kruschke, J. K. (2018). Rejecting or accepting parameter values in Bayesian estimation. *Advances in methods and practices in psychological science, 1*(2), 270-280.

Mensah, N., & Adukpo, T. K. (2025). Impact of government expenditure on economic growth of Ghana. *Asian Journal of Economics, Business and Accounting, 25*(3), 232-247.

Musgrave, R. A., & Musgrave, P. B. (1980). *Public finance in theory and practice.* (No Title).

Peacock, A. T., & Wiseman, J. (1961). Front matter, the growth of public expenditure in the United Kingdom. In *The growth of public expenditure in the United Kingdom* (pp. 32-0). Princeton University Press.

Peña, G. (2023). Interest rates affect public expenditure growth. *Quantitative Finance and Economics, 7*(4), 622–645.

Rasheed, O. N. (2023). The Effect of Unemployment on Economic Growth in Nigeria. *American Journal of Applied Statistics and Economics, 2*(1), 11–14.

Sineviciene, L., & Vasiliauskaite, A. (2012). Fiscal policy interaction with private investment: The case of the baltic states. *Engineering economics, 23*(3), 233-241.

Stiglitz, J. E., & Rosengard, J. K. (2015). *Economics of the public sector: Fourth international student edition.* WW Norton & Company.

Wagner, A. (1883). Three Extracts on Public Finance, reprinted in R.A. Musgrave and A.T. Peacock (eds.), *Classics in the Theory of Public Finance, London: Macmillan, 1958*, (pp. 1-15).