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Macroeconomic Determinants of Economic Growth in Zambia: Evidence From an ARDL-ECM Analysis, 1990-2024

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Abstract

This study examined the macroeconomic determinants of economic growth in Zambia over the period 1990-2024 using an autoregressive distributed lag-error correction model (ARDL-ECM). Annual secondary data were drawn from the World Development Indicators for Gross Domestic Product (GDP), inflation, the real effective exchange rate, government expenditure, the real interest rate, and unemployment. Augmented Dickey-Fuller tests showed that all variables were integrated of order one, which justified the ARDL bounds-testing approach. The Schwarz Information Criterion selected an ARDL(1,0,2,0,2,1) specification, and the bounds test confirmed cointegration (F = 5.6746). The long-run estimates showed that the real effective exchange rate (b = 3.4725, p = 0.0011) and government expenditure (b = 0.0847, p = .0336) were positive and statistically significant determinants of GDP, whereas inflation, the real interest rate, and unemployment were not statistically significant in the long run. In the short run, changes in the real effective exchange rate, lagged changes in government expenditure, and current changes in unemployment significantly affected GDP. The error-correction term was negative and statistically significant (b = -0.1860, p < 0.001), implying that about 18.6% of short-run disequilibrium was corrected each year. Diagnostic tests indicated no serial correlation, no heteroskedasticity, normally distributed residuals, and correct functional form. The findings suggest that Zambia's growth path has been shaped primarily by exchange-rate conditions and the quality and persistence of fiscal activity, while labour-market disruptions matter more in the short run than in the long run. The article recommends exchange-rate stabilisation, more productive public spending, improved fiscal efficiency, and growth strategies that support employment creation.

Keywords: Economic growth, ARDL, error correction model, exchange rate, government expenditure

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1. Introduction

Economic growth remains central to improvements in living standards, job creation, fiscal space, and structural transformation. In Zambia, the growth question is especially important because output performance has long been shaped by copper-price cycles, exchange-rate pressures, inflationary episodes, fiscal stress, and recurrent supply shocks. Recent official updates show that the economy has remained resilient but uneven, with growth increasingly influenced by mining, services, electricity constraints, climate shocks, and external conditions (African Development Bank Group, 2025; World Bank, 2025a; Zambia Statistics Agency, 2025).

The broader empirical literature shows that growth does not respond to one macroeconomic variable in isolation. Government expenditure can stimulate demand and raise productive capacity when directed toward infrastructure and human capital, but its effects depend on composition and efficiency (Barro, 1990). Exchange-rate conditions matter because they shape external competitiveness, imported inflation, investor confidence, and the domestic currency burden of foreign obligations; in developing economies, real exchange-rate movements have often been found to carry meaningful growth implications (Rodrik, 2008). Inflation and real interest rates affect saving, investment, and macroeconomic stability, while unemployment signals underutilised productive capacity and weak transmission from growth to livelihoods.

For Zambia, existing studies have made useful contributions, but the evidence remains incomplete. Chirwa and Odhiambo (2017) identify investment, human capital, government consumption, trade, and aid as important growth drivers, while Chirwa and Odhiambo (2019) show dynamic causal linkages between growth and a broader set of macroeconomic variables. Mulungu and Ng'ombe (2017) also show that Zambia's long-term growth performance has been structurally uneven across sectors. Even so, there remains limited updated country-specific evidence that jointly examines inflation, the real effective exchange rate, government expenditure, the real interest rate, and unemployment within a single cointegrated framework over a long reform-era sample extending to 2024.

This article addresses that gap by estimating both the long-run and short-run relationships between Zambia's GDP and five macroeconomic drivers using annual data from 1990 to 2024 and an ARDL-ECM framework. The article makes two contributions. First, it provides updated Zambia-specific evidence using a method suited to small samples and mixed lag structures. Second, it presents the findings in a policy-facing form that speaks directly to exchange-rate management, fiscal policy, labour-market conditions, and macroeconomic coordination. To preserve internal consistency with the underlying data used in estimation, the dependent variable is referred to throughout as GDP, because the model was estimated using the World Development Indicators GDP series in current US dollars rather than a real GDP series.

2. Methods

The study adopted a quantitative explanatory time-series design using annual secondary data for Zambia covering 1990-2024 (N = 35). Data were sourced from the World Development

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Indicators. The dependent variable was GDP, measured in current US dollars and transformed into natural logarithms for estimation. The explanatory variables were inflation (annual consumer price inflation), the real effective exchange rate (2010 = 100, logged), the real interest rate (%), government expenditure as a share of GDP (%), and the unemployment rate as a share of the labour force (%).

The ARDL approach was selected because it is suitable for relatively small samples and allows variables to enter the model with different lag lengths, provided none is integrated of order two (Pesaran et al., 2001). Stationarity was first tested using the Augmented Dickey-Fuller procedure (Dickey & Fuller, 1979, 1981). After confirming that all variables were I (1), the study estimated ARDL models with a maximum lag length of two years, which is appropriate for annual macroeconomic data and avoids over-parameterisation.

Model selection was based on the Schwarz Information Criterion, which chose an ARDL (1,0,2,0,2,1) specification. A bounds test was then used to determine whether a stable long-run relationship existed among the variables. Once cointegration was confirmed, long-run coefficients were estimated and the model was re-parameterised into an error-correction form to capture short-run dynamics and the speed with which GDP returned to its long-run equilibrium path (Engle & Granger, 1987; Pesaran et al., 2001).

The empirical relationship can be represented in compact form as lnGDP_t = f (INF_t, lnREER_t, RIR_t, GEXP_t, UNEM_t). Diagnostic testing was used to assess whether the model satisfied key econometric assumptions. Specifically, the study applied the Breusch-Godfrey LM test for serial correlation, the Breusch-Pagan-Godfrey test for heteroskedasticity, the Jarque-Bera test for residual normality, and the Ramsey RESET test for functional-form correctness.

3. Ethical considerations

This study used publicly available secondary data from the World Development Indicators. No human participants were involved; therefore, formal ethical approval and informed consent were not required.

4. Results

Table 1 presents the descriptive statistics for the series used in the analysis. Zambia's GDP averaged US$14.10 billion over the study period, with substantial dispersion that reflects the country's uneven growth path. Government expenditure averaged 24.38% of GDP, while unemployment averaged 11.61% of the labour force. Inflation and the real interest rate displayed the most irregular distributions, suggesting that these variables were more exposed to episodic shocks and policy adjustments than the other series.

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Table 1 Descriptive Statistics for the Study Variables, Zambia, 1990-2024

Variable	Mean	Median	Min	Max	SD	Skewness	Kurtosis	Jarque-Bera (p)
GDP (current US$, billions)	14.10	14.10	3.18	29.20	9.93	0.14	1.33	4.18 (.124)
Government expenditure (% of GDP)	24.38	23.93	17.81	34.03	4.78	0.32	2.00	2.07 (.355)
Inflation (annual rate, proportion)	0.287	0.179	0.066	1.584	0.365	2.55	8.65	84.54 (<.001)
Real effective exchange rate (2010 = 100)	76.31	73.20	47.00	112.59	19.52	0.10	1.67	2.66 (.265)
Unemployment rate (% of labour force)	11.61	12.00	5.03	19.70	4.58	0.21	1.87	2.13 (.344)
Real interest rate (%)	4.96	4.55	2.10	12.69	2.65	1.47	4.42	15.48 (<.001)

Note. GDP and the real effective exchange rate were log-transformed for estimation. Inflation is reported here in proportion form for consistency with the analysed series.

These descriptive results show that the variables entering the model differed not only in scale, but also in stability across the sample period. GDP and the real effective exchange rate were relatively symmetrically distributed, whereas inflation and the real interest rate were highly skewed and non-normal. This pattern is consistent with Zambia's exposure to episodic macroeconomic shocks, including inflation surges, exchange-rate pressures, and changes in financing conditions. The wide dispersion in GDP also indicates that the study period captured both low-output and high-output episodes, making the dataset suitable for examining long-run macroeconomic relationships. However, the non-normality of inflation and the real interest rate confirms the need for formal time-series testing rather than relying on descriptive statistics alone. Table 2 reports the Augmented Dickey-Fuller test results. None of the variables was stationary in levels, but all became stationary after first differencing. The evidence therefore classifies all six series as integrated of order one, which justified the ARDL bounds-testing strategy and ruled out the presence of I(2) variables.

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Table 2 Augmented Dickey-Fuller Unit Root Test Results

Variable	ADF at level (t, p)	ADF at first difference (t, p)	Order
GDP (current US$)	-0.677 (.839)	-5.401 (<.001)	I(1)
Government expenditure (% of GDP)	-1.590 (.477)	-5.619 (<.001)	I(1)
Inflation (annual rate)	-2.365 (.159)	-5.576 (<.001)	I(1)
Real effective exchange rate (2010 = 100)	-1.664 (.440)	-5.766 (<.001)	I(1)
Unemployment rate (% of labour force)	-1.138 (.689)	-5.310 (<.001)	I(1)
Real interest rate (%)	-2.401 (.149)	-4.162 (.003)	I(1)

Note. The null hypothesis is that the series has a unit root. Rejection at first difference indicates stationarity after differencing.

The unit-root results are important because they show that Zambia's macroeconomic series followed stochastic trends over the period under review. Since stationarity was achieved only after first differencing, estimating the variables in levels without testing for cointegration could have produced spurious relationships. The finding that all variables are integrated of order one, with no evidence of I(2) behaviour, supports the use of the ARDL bounds-testing procedure. It also means that the substantive interpretation should focus on whether the variables share a stable long-run equilibrium relationship, rather than on their level movements alone.

The Schwarz Information Criterion selected an ARDL (1,0,2,0,2,1) specification. The bounds test produced an F-statistic of 5.6746, which exceeded the 5% upper critical bound of 4.013, confirming cointegration. Table 3 therefore presents the long-run coefficients estimated from the cointegrating relationship. The long-run results show that the real effective exchange rate and government expenditure were the only statistically significant determinants of GDP. The real effective exchange rate was positive and highly significant, while government expenditure was positive and significant at the 5% level. Inflation and the real interest rate carried negative signs, but neither reached statistical significance. Unemployment was positive but statistically insignificant in the long run.

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Table 3 ARDL Bounds Test and Long-Run Coefficients

Panel A. Bounds test for cointegration				
F-statistic	**10% I(0)/I(1)**	**5% I(0)/I(1)**	**1% I(0)/I(1)**	**Decision**
5.6746	2.331 / 3.417	2.804 / 4.013	3.900 / 5.419	Cointegration confirmed
Panel B. Estimated long-run coefficients				
Regressor	**Coefficient**	**SE**	**t**	**p**
Inflation	-0.7331	0.5804	-1.2631	.2173
Log real effective exchange rate	3.4725	0.9470	3.6667	.0011
Real interest rate	-0.0779	0.0513	-1.5180	.1406
Government expenditure	0.0847	0.0378	2.2396	.0336
Unemployment	0.0482	0.0726	0.6635	.5126

Note. The preferred specification was ARDL(1,0,2,0,2,1), selected by the Schwarz Information Criterion under a restricted intercept and no trend.

The long-run estimates provide the central empirical message of the article. The real effective exchange rate has the largest and most statistically reliable coefficient, indicating that exchange-rate conditions were closely associated with Zambia's output path over the long run. Government expenditure is also statistically significant, although its coefficient is more modest, suggesting that fiscal activity supports GDP when its effects accumulate over time. By contrast, inflation, the real interest rate, and unemployment do not show independent long-run significance after controlling for the other variables in the cointegrating system. This pattern points to the need for policy emphasis on exchange-rate stability and productive public spending, while recognising that monetary and labour-market variables may operate through indirect or short-run channels.

Table 4 reports the short-run error-correction estimates and the main diagnostic statistics. The error-correction term was negative and statistically significant, confirming that deviations from the long-run path were corrected over time. Its magnitude suggests that approximately 18.6% of disequilibrium was eliminated each year. In the short run, current and lagged changes in the real effective exchange rate were significant, the lagged change in government expenditure was negative and significant, and current unemployment shocks reduced GDP. Diagnostic tests showed that the model was well behaved: residuals were free from serial correlation and heteroskedasticity, approximately normal, and correctly specified.

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Table 4 Error-Correction Estimates and Diagnostic Tests

Panel A. Error-correction model estimates				
Regressor	**Coefficient**	**SE**	**t**	**p**
Error-correction term (ECT t-1)	-0.1860	0.0260	-7.1464	<.001
Change in log real effective exchange rate	1.0870	0.1102	9.8592	<.001
Change in log real effective exchange rate (lag 1)	-0.4089	0.1279	-3.1961	.0035
Change in government expenditure	-0.0003	0.0048	-0.0581	.9541
Change in government expenditure (lag 1)	-0.0146	0.0047	-3.1266	.0042
Change in unemployment	-0.0179	0.0086	-2.0925	.0459
Panel B. Diagnostic tests				
Test	Statistic	P	Null hypothesis	Decision
Breusch-Godfrey LM	F = 0.703	.507	No serial correlation	Fail to reject
Breusch-Pagan-Godfrey	F = 0.965	.505	Homoskedasticity	Fail to reject
Jarque-Bera	JB = 0.483	.785	Normal residuals	Fail to reject
Ramsey RESET	F = 0.733	.402	Correct specification	Fail to reject

Note. Inflation and the real interest rate do not appear in the error-correction equation because the selected ARDL specification assigned them zero short-run lags.

The short-run results show a more dynamic adjustment process than the long-run equation. The negative and statistically significant error-correction term confirms that GDP responds to deviations from equilibrium, although the adjustment speed of 18.6% per year indicates gradual correction rather than rapid convergence. The significant current and lagged effects of the real effective exchange rate reinforce its importance as both a short-run and long-run driver of output. The negative lagged fiscal effect suggests that government spending changes may not translate immediately into growth and may depend on implementation quality, financing conditions, and expenditure composition. The significant negative unemployment effect further indicates that labour-market disruptions have immediate output costs. The diagnostic results strengthen

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confidence in these estimates because the model satisfies the main residual and specification tests.

5. Discussion

The evidence indicates that Zambia's GDP over 1990-2024 was driven most consistently by exchange-rate conditions and government expenditure. Among the variables examined, the real effective exchange rate emerged as the strongest determinant, both statistically and substantively. This finding is economically plausible in a commodity-dependent economy where shifts in external competitiveness, imported input costs, and investor expectations quickly feed into output dynamics. It also resonates with broader evidence that real exchange-rate conditions can have growth effects in developing economies, especially where the tradable sector remains central to structural transformation (Rodrik, 2008). The finding is broadly consistent with Chirwa and Odhiambo's (2019) emphasis on the macroeconomic relevance of exchange-rate dynamics in Zambia.

Government expenditure was positive and significant in the long run, but its short-run effect was more nuanced. The long-run result suggests that sustained fiscal activity can support output when expenditure contributes to infrastructure, service delivery, and productive capacity. This sits well with endogenous-growth arguments that productive public expenditure can raise the economy's long-run path (Barro, 1990). Yet the short-run results show that fiscal effects may be delayed or even temporarily contractionary when spending is financed under tight conditions, implemented inefficiently, or concentrated in outlays with weak multipliers. In practical terms, the findings imply that the quality, timing, and composition of spending matter more than expenditure growth on its own.

Inflation and the real interest rate were not statistically significant in the long run, even though both carried the expected negative signs. This does not mean that these variables are irrelevant to policy; rather, it suggests that within the joint system estimated here, their direct long-run association with GDP was weaker than that of the exchange rate and fiscal policy. One reasonable interpretation is that inflation and interest rates may matter indirectly through exchange-rate pass-through, confidence, investment timing, or financing conditions, without leaving a strong stand-alone long-run coefficient in this particular specification. Similar variation in the role of inflation and financing conditions is reported in the wider growth literature, including evidence from other African economies (Ho & Iyke, 2020).

Unemployment did not show a statistically reliable long-run relationship with GDP, but it was significant in the short run in the error-correction equation, where unemployment shocks reduced output. This pattern is also plausible. Labour-market disruptions can depress demand, reduce utilisation, and weaken short-term output, even when long-run structural relationships are harder to detect in annual aggregate data. The result therefore supports treating employment not merely as a social indicator but as part of the macroeconomic growth process itself.

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The negative and statistically significant error-correction term confirms that Zambia's macroeconomic system exhibits convergence toward a long-run equilibrium path. However, the adjustment speed of 18.6% per year is relatively gradual. This means that shocks are not absorbed immediately and that policy effects accumulate over time rather than producing instant gains. For macroeconomic management, the implication is clear: policy consistency matters. Exchange-rate stabilisation, prudent but growth-supportive fiscal policy, and employment-sensitive reforms need to be sustained rather than episodic.

The article also has an important measurement implication. Because the empirical model uses GDP in current US dollars, the findings should be interpreted as evidence on the macroeconomic determinants of Zambia's aggregate output as operationalised in the source dataset. This does not invalidate the analysis, but it does mean that future research would benefit from re-estimating the model with a fully real output measure to test the robustness of the results under an explicitly inflation-adjusted growth indicator.

6. Conclusion and Policy Implications

This article examined the macroeconomic determinants of economic growth in Zambia using annual data from 1990 to 2024 and an ARDL-ECM framework. The results confirmed a stable long-run relationship among GDP, inflation, the real effective exchange rate, the real interest rate, government expenditure, and unemployment. Two variables stood out as long-run determinants of GDP: the real effective exchange rate and government expenditure. In the short run, exchange-rate changes, lagged fiscal effects, and unemployment shocks significantly affected GDP, while the economy adjusted gradually toward equilibrium at a speed of about 18.6% per year.

Three policy implications follow directly from the evidence. First, exchange-rate management should be treated as a core growth issue rather than a narrow monetary concern. Reducing excessive volatility, improving foreign-exchange liquidity, and supporting export diversification would strengthen macroeconomic resilience. Second, the positive long-run role of government expenditure suggests that fiscal policy can support growth, but only when spending is productive, timely, and efficiently implemented. This points to the importance of prioritising infrastructure, energy, agricultural support systems, and human capital while improving public expenditure quality. Third, the significance of unemployment in the short run shows that growth policy should be employment aware. Macroeconomic recovery strategies that do not translate into jobs are likely to be weaker and less durable.

Overall, the evidence suggests that Zambia's growth performance over the last three decades has depended most strongly on external-price conditions and fiscal activity, with labour-market pressures shaping short-run adjustment. A macroeconomic strategy that combines exchange-rate stability, disciplined but growth-enhancing public expenditure, and stronger employment-supporting reforms is therefore more likely to deliver durable gains in output and welfare.

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8. Author's Biography

Chipego Kafunga Hachinene is a Technical Assistant with the Jobs Accelerator Project under the Office of the Economic Adviser to the President, and a Researcher and Lecturer at Chreso University, Lusaka, Zambia. His work focuses on research, policy analysis, monitoring and evaluation, and data analytics in support of evidence-based decision-making and development outcomes in Zambia.

Nicholus Obby Mainza is a Chief Agriculture Economist at the Ministry of Agriculture in Zambia, a part-time lecturer with Zambia Open University, an agribusiness expert offering consultancy services as a freelancer, an entrepreneur, a business masterclass tutor, and a researcher with interests in critical and analytical thinking. He currently serves as the National Secretary of the Economics Association of Zambia and was awarded Economist of the Year in 2025.

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10. Data Availability

The dataset is available from the corresponding author upon reasonable request.

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