

Stagflation and economic growth in Zambia: A vector error correction model analysis of gross domestic product

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ABSTRACT

Stagflation remains one of the most serious macroeconomic challenges facing developing economies because it combines inflationary pressure, weak growth, and structural instability within the same economic environment. This study was guided by the Expectations-Augmented Phillips Curve Theory, complemented by the Structuralist Theory of Inflation and the Resource-Dependence Theory, which together explain how inflation, labour-market weakness, supply-side shocks, and commodity dependence interact to constrain economic growth. This study examines the effect of stagflation on Zambia's economic growth as measured by Gross Domestic Product (GDP). Zambia provides a compelling case for this analysis because inflation, exchange-rate instability, external debt stress, commodity-price volatility, and labour-market weakness have repeatedly interacted to undermine growth in a copper-dependent economy. Using annual time-series data covering the period 1964 to 2024, the study employs a Vector Error Correction Model (VECM) after conducting unit-root, lag-selection, multicollinearity, and Johansen cointegration tests. The findings confirm the existence of a stable long-run relationship between GDP and the principal stagflation-related drivers. Exchange-rate depreciation, labour-market weakness, copper-supply disruptions, and inefficient government spending are found to constrain long-run growth, while external debt and population growth display positive long-run coefficients, reflecting the growth-supporting role of debt-financed investment and demographic demand under certain conditions. The short-run GDP equation reports a negative error-correction coefficient, indicating a slow adjustment process toward long-run equilibrium following macroeconomic shocks. Further dynamic evidence shows that inflation and exchange-rate volatility account for a meaningful share of GDP fluctuations, while copper-price declines and debt-service pressures generate notable output losses. The study concludes that stagflation in Zambia is not merely a temporary cyclical disturbance, but a structural constraint on economic growth and transformation. It therefore recommends export diversification, stronger exchange-rate resilience, more productive public expenditure, prudent debt management, and labour-market strengthening as essential pillars of a coordinated policy response.

Keywords: Economic Growth, GDP, Macroeconomic Instability, Stagflation, VECM, Zambia

I. INTRODUCTION

Stagflation remains one of the most difficult macroeconomic conditions for policymakers because it combines rising prices, weak labour-market performance, and stagnant or declining output. In a developing and commodity-dependent economy such as Zambia, this challenge is intensified by external vulnerability, import dependence, recurrent fiscal pressure, and a narrow export base centred on copper. When copper prices fall, foreign-exchange earnings decline, the domestic currency weakens, imported production costs rise, inflation accelerates, and growth slows. These interlocking transmission channels make stagflation especially harmful in Zambia's economic structure (Bruno & Easterly, 1998; Cashin et al., 2002). This study addresses the central question of how stagflation influences Zambia's economic growth as measured by GDP. Zambia's historical experience makes this an important subject of inquiry. The country has faced several stagflationary episodes, including the oil and commodity disturbances of the 1970s, the prolonged inflationary crisis of the 1980s and early 1990s, the exchange-rate and commodity-price shock of 2015, and the pandemic-era disruptions. These episodes undermined output growth, weakened purchasing power, constrained policy space, and delayed structural transformation.

The research speaks to several strands of literature. First, it engages the Phillips Curve debate by examining an economy in which inflation and labour-market distress may rise alongside stagnant output, contrary to the simplistic inflation-unemployment trade-off envisaged in early macroeconomic models (Friedman, 1968; Phelps, 1967). Second, it contributes to the structuralist and resource-dependence literature by showing how external shocks interact with weak diversification, exchange-rate pass-through, and fiscal constraints to weaken growth (Auty, 1990; Sachs & Warner, 1995; Mehlum et al., 2006). Third, it adds Zambia-specific evidence to empirical work on inflation-growth dynamics, exchange-rate volatility, and copper-price shocks (Chipili, 2013; Chikalipah, 2019; Lungu & Mulenga, 2024).

The broader theoretical literature has shown that the simple inflation-unemployment trade-off embedded in early Phillips Curve reasoning breaks down under supply shocks, inflation expectations, and structural rigidities (Friedman, 1968; Phelps, 1967). Structuralist and resource-dependence perspectives further show that commodity-exporting developing economies are especially vulnerable to inflation-growth crises because global price shocks transmit through exchange rates, public revenue, debt, and imported input costs (Auty, 1990; Sachs & Warner, 1995; Mehлум et al., 2006). Therefore, Zambia provides a strong case through which these arguments can be tested econometrically. Methodologically, the study relies on a Vector Error Correction Model (VECM) because the variables are non-stationary in levels but cointegrated, implying that short-run deviations occur around a long-run equilibrium path. This approach is well suited to macroeconomic systems in which output, inflation, interest rates, exchange rates, debt, and commodity variables are jointly determined over time (Johansen, 1988; Engle & Granger, 1987; Pesaran et al., 2001).

1.1 Statement of the Problem

Stagflation, characterized by concurrent high inflation, stagnant economic expansion, and escalating unemployment, presents a persistent macroeconomic difficulty for developing economies reliant on natural resources. In Zambia, this condition is not a transient occurrence but rather a structural issue, stemming from the nation's significant dependence on copper, which constitutes over 70 percent of export earnings and about 15 percent of GDP (Chikalipah, 2019). Consequently, fluctuations in copper prices precipitate currency devaluation, inflation stemming from imported goods, deficits in fiscal revenue, and weaknesses within the labour market, thereby generating typical stagflationary circumstances (Chipili, 2013; Cashin et al., 2002).

These observed patterns directly challenge the traditional Phillips Curve's inverse relationship between inflation and unemployment (Phillips, 1958; Samuelson & Solow, 1960), and they are more consistent with explanations rooted in expectations-augmented models, structuralist perspectives, and the resource-curse hypothesis (Friedman, 1968; Phelps, 1967; Auty, 1990; Sachs & Warner, 1995; Mehлум et al., 2006). Although stagflationary periods have persisted, particularly in the 1970s, 1980s to 1990s, 2015, and during the COVID-19 pandemic, empirical investigations concerning Zambia continue to analyze inflation, exchange-rate fluctuations, copper prices, debt levels, and labour market dynamics in a fragmented manner (Chipili, 2013; Chikalipah, 2019; Lungu & Mulenga, 2024). However, only a few studies have examined these variables together in a single cointegrated framework.

This fragmentation presents a significant challenge, especially considering the Zambian Government's Eighth National Development Plan (8NDP). The plan aims for a 4.5 percent annual real GDP growth rate by 2026 according to Zambia Ministry of Finance in 2023. The persistence of stagflation directly undermines this target by eroding purchasing power, discouraging investment, constraining employment creation, and reducing the fiscal space required for structural transformation. Consequently, without substantial evidence regarding the interconnected dynamics of stagflation, policymakers are deprived of the comprehensive understanding required to formulate cohesive macroeconomic and structural strategies.

This research therefore aims to address the above gap by investigating the combined long-term and short-term impacts of stagflation on Zambia's economic expansion, employing annual data spanning from 1964 to 2024 within a Vector Error Correction Model (VECM) framework. Through the quantification of the respective influences and transmission pathways of various stagflation catalysts, the study furnishes a foundation of empirical evidence to inform the development of more efficacious policy interventions in economies reliant on natural resources.

1.2 Research Objective

To analyse the effect of stagflation on Zambia's economic growth as measured by GDP.

1.3 Research Question

How does stagflation affect Zambia's economic growth as measured by GDP?

II. LITERATURE REVIEW

2.1 Theoretical Review

The theoretical foundations of stagflation, characterized by simultaneously high inflation, weak economic growth, and elevated unemployment, are rooted in the breakdown of the conventional Phillips Curve framework. This model was subsequently refined through expectations-augmented frameworks, structuralist analyses applicable to developing nations, and the resource-curse hypothesis. These perspectives, when considered together, elucidate the conditions under which inflation and labour market deficiencies can coexist, especially within commodity-dependent economies like Zambia. In these circumstances, external shocks, weaknesses within institutions, and limitations on the supply side amplify macroeconomic instability. As a result, this research utilizes a comprehensive theoretical framework

to examine Zambia's copper-dependent economy, focusing on the interplay between cost-push elements, expectation dynamics, and distortions stemming from resource allocation.

2.1.1 The Phillips Curve and the Expectations-Augmented Phillips Curve

A.W. Phillips introduced the original Phillips Curve. Phillips (1958) identified a consistent inverse relationship between wage inflation and unemployment in the United Kingdom using data for the period 1861 to 1957. This empirical regularity was subsequently generalized by Samuelson and Solow (1960) to the United States and interpreted as a policy menu: governments could exploit a short-run trade-off by tolerating moderate inflation in exchange for lower unemployment. The post-war Keynesian approach to managing demand was based on this framework. It suggested that policymakers could control overall demand to maintain full employment, with only a small increase in inflation. During the stagflation episodes of the 1970s, any attempt to push unemployment below its natural rate, determined by labour-market frictions, institutions and structural factors, would only accelerate inflation as expectations adjust upward. In the long run, the Phillips Curve is vertical at the natural rate of unemployment and there is no exploitable trade-off. Supply shocks, such as the 1973 and 1979 oil-price spikes, further shift the short-run curve outward, producing simultaneous inflation and output contraction, precisely the stagflation phenomenon observed globally.

These insights were formalized in the expectations augmented Phillips Curve, which emerged in response to the stagflation episodes of the 1970s, when rising inflation occurred alongside rising unemployment and stagnant output, thereby invalidating the stable trade off suggested by the original Phillips Curve. Milton Friedman (1968) and Edmund Phelps (1967) offered the foundational theoretical challenge through the natural-rate hypothesis and the expectations-augmented Phillips Curve. They posited that both employees and employers develop inflation expectations adaptively, or rationally, in subsequent elaborations, and negotiate concerning real, as opposed to nominal, wages. Any attempt to push unemployment below its natural rate, determined by labour-market frictions, institutions, and structural factors, would only accelerate inflation as expectations adjusted upward. In the long run, the Phillips Curve becomes vertical at the natural rate of unemployment, implying that no permanent trade-off exists between inflation and unemployment. Adverse supply shocks, such as the oil-price shocks of 1973 and 1979, can also shift the short-run Phillips Curve outward, producing simultaneous inflation and output contraction, precisely the stagflation phenomenon observed globally. These insights were formalized in the expectations-augmented equation:

$$\pi_t = \pi_t^e + \alpha (U_n - U_t) + S_t + \varepsilon_t$$

Where:

π_t = actual inflation

π_t^e = expected inflation

U_n = natural unemployment rate

U_t = actual unemployment.

S_t = supply Shocks

ε_t = stochastic error term

When expectations fully adjust so that expected inflation equals actual inflation ($\pi_t^e = \pi_t$), the long-run Phillips curve becomes vertical. Later research, including Gordon's (2011) "triangle model," included inertia, demand, and supply shocks to explain the ongoing stagflationary pressures. Structuralist viewpoints extend the utility of the expectations-augmented model to include developing countries, emphasizing that inflation often arises from cost-push elements and supply-side limitations, rather than an oversupply of demand. This perspective is consistent with earlier structuralist contributions that explain inflation in developing economies through supply bottlenecks, imported costs, and institutional rigidities rather than demand expansion alone (Olivera, 1964).

In import-dependent economies, inflation may intensify even when output remains weak or stagnant. This is particularly likely when exchange-rate depreciation, food-price pressures, and energy-cost shocks raise domestic production costs. Olivera's (1964) early work on structural inflation in Latin America showed how agricultural problems, a lack of foreign exchange, and limited government spending contributed to "inertial" inflation, regardless of monetary policy. These supply-side limitations are especially pronounced in economies that depend on imports and have a narrow economic base. In these economies, currency depreciation or changes in commodity prices directly affect domestic costs, without any corresponding improvements in productivity.

In the case of Zambia, a heavy dependence on imported fuel, machinery, and consumer goods implies that copper-price fluctuations, combined with kwacha volatility, can concurrently exacerbate inflation and impede non-mining output, precisely the stagflationary process that structuralists anticipate. The resource-dependence and resource-curse literature offers a complementary perspective by linking supply-side vulnerability to political-economy distortions. Auty (1990) introduced the concept of the "resource curse" to explain the frequent underperformance of

mineral-rich economies, notwithstanding their substantial rent streams. Sachs and Warner (1995, 2001) formalized the empirical regularity that a high share of primary-commodity exports in GDP is negatively associated with long-run economic growth, even after controlling for standard growth determinants.

One way this happens is through the Dutch disease effect. This occurs when a rise in the value of a currency makes it harder for sectors that trade internationally to compete. Furthermore, rent-seeking behavior and corruption can misallocate resources away from productive investment. Procyclical fiscal policy, which exacerbates economic fluctuations, constitutes another contributing factor. This argument is closely related to the Dutch disease and resource-curse literature, which shows that commodity booms can weaken tradable sectors and increase long-run vulnerability where institutional quality is weak (Auty, 1990; Mehlum et al., 2006).

Mehlum et al. (2006) expanded upon this perspective by illustrating that institutional quality serves as a critical moderating variable. In particular, within settings where institutions favoring "grabbers" predominate, resource rents often incite rent-seeking behaviors, thereby hindering economic expansion. Conversely, in environments that are "producer-friendly," such rents can promote diversification and contribute to enduring development. Zambia exemplifies the curse archetype because copper accounts for over 70 percent of exports and a large share of government revenue, yet repeated price shocks have produced exchange-rate volatility, fiscal procyclicality, and limited structural transformation. Copper dependence therefore links directly to the stagflationary channels identified in both structuralist and resource-curse theories, imported-cost inflation, real-exchange-rate misalignment, and growth-retarding volatility.

Collectively, these theoretical strands which are the Phillips Curve breakdown, expectations augmentation, structuralist supply rigidities, and the institutionally conditioned resource curse, furnish a coherent framework for analysing stagflation in Zambia. They predict that copper-price shocks will simultaneously elevate inflation through cost-push and exchange-rate channels and depress non-mining growth through volatility and crowding-out, with weak institutions exacerbating the feedback loops. This study operationalizes this framework empirically by estimating the joint growth effects of these channels within a single cointegrated system.

2.2 Empirical Review

A substantial body of empirical evidence corroborates the theoretical prediction that macroeconomic instability, particularly high and volatile inflation, undermines long-run growth, with especially pronounced effects in resource-dependent developing economies. Bruno and Easterly (1998) provide one of the most influential cross-country analyses, demonstrating that inflation crises, particularly those involving annual inflation rates above approximately 40 percent, are associated with a sharp decline in average per-capita growth of about 1.5 to 2 percentage points.

Stabilization episodes, on the other hand, tend to generate rapid growth recoveries. After controlling for other determinants of growth, the negative effect of inflation remains robust, a pattern observed in both developed and developing economies. This indicates that inflation is not simply a by-product of weak growth, but an important constraint on economic expansion itself. Evidence from Zambia supports these broader international findings while also revealing country-specific transmission mechanisms. In particular, Chirwa et al. (2015), applying the autoregressive distributed lag (ARDL) bounds-testing approach to data covering 1960 to 2013, found a stable long-run relationship among investment, human capital, trade openness, government expenditure, and economic growth. In contrast, inflation and macroeconomic instability were shown to have significant adverse effects on economic growth in both the short run and the long run.

Further research by Chirwa et al. (2015) corroborates the notion that inflation uncertainty undermines investment choices, thereby impeding the formation of productive capital. Chipili's (2013) study highlights exchange-rate volatility as a major stagflationary force in Zambia. The study shows that fluctuations in the kwacha negatively affect trade balances, increase import expenditures, and weaken overall macroeconomic performance, especially during periods of falling copper prices. Furthermore, Chikalipah's (2019) study directly examines the economic consequences of changes in copper prices. Based on an analysis of quarterly data from 1995 to 2015, the study reports a statistically significant positive relationship between copper prices and real GDP growth. In contrast, price drops can lead to negative economic effects, such as reduced government revenue, currency depreciation, and increased inflation. These studies, taken together, demonstrate how Zambia's reliance on copper transforms external price volatility into domestic stagflationary pressures. Comparative examinations of economies rich in resources offer additional evidence for the crucial role of institutional frameworks and policy tools in mitigating stagflation. Botswana, frequently presented as a counterexample to the resource curse, has sustained relatively high economic growth through prudent revenue management and stronger fiscal institutions.

This was attributed to its successful administration of diamond revenues through the Botswana Pula Fund, the implementation of sound fiscal policies, and diversification into non-mining sectors (Hillbom, 2008; Sarraf & Jiwaji, 2001). Chile, by contrast, used copper stabilization funds, counter-cyclical fiscal policies, and institutional reforms to reduce macroeconomic instability and support long-term growth (Frankel, 2012). Reinhart and Rogoff (2009), in their panoramic study of financial and debt crises, document that resource-dependent economies with weak fiscal institutions

suffer deeper and more prolonged stagflationary episodes; credible stabilization mechanisms, by contrast, shorten recovery times and reduce output costs. These successes stand in sharp contrast to Zambia's experience of repeated copper-driven boom-bust cycles, underscoring the institutional dimension emphasized by Mehlum et al. (2006).

Despite these valuable contributions, a critical gap persists in the literature. Most country-specific studies, including those on Zambia, analyse inflation, growth, exchange-rate volatility, public debt, and labour-market outcomes in isolation or through pairwise relationships. Yet stagflation is inherently a systemic phenomenon in which these variables interact and reinforce one another through cost-push, expectation, and resource-curse channels. Single-equation or partial-equilibrium approaches therefore fail to capture the joint dynamics and long-run equilibrium relationships among the variables. This study seeks to address this gap by incorporating several stagflation-related factors such as copper prices, exchange-rate fluctuations, inflation expectations, and institutional indicators, into a single cointegrated Vector Error-Correction Model. This integrated empirical approach allows a more comprehensive examination of the theoretical predictions and the relative contribution of major stagflation channels to economic growth. Consequently, this provides policy-relevant insights for resource-dependent economies aiming to avoid stagflation.

III. METHODOLOGY

The study employed a quantitative time-series research design using annual data for the period 1964 to 2024. The dependent variable is the natural logarithm of Real Gross Domestic Product ($\ln GDP_t$). The explanatory variables capture the principal stagflation transmission channels identified in the theoretical and empirical literature, namely inflation measured by the Consumer Price Index (CPI_t), labour-market conditions proxied by the Labour Force Participation Rate ($LFPR_t$), the Nominal Exchange Rate ($\ln EXR_t$), Copper Supply ($\ln COPSUP_t$), the Human Capital Index (HCI_t), Population Growth (PG_t), Government Spending ($\ln GS_t$) External Debt ($\ln ED_t$), Copper Prices ($\ln COP_t$), and the Central Bank Policy Rate ($CBPR_t$).

Data were obtained from the Bank of Zambia, the Zambia Statistics Agency, the World Bank's World Development Indicators, the International Monetary Fund's International Financial Statistics, and international commodity-market sources. Preliminary diagnostic tests included unit-root testing through the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, multicollinearity checks using variance inflation factors, lag-length selection using the Akaike and Schwarz information criteria, and cointegration analysis through the Johansen trace test. Given that the variables are predominantly integrated of order one and cointegrated, the unrestricted vector autoregression (VAR) was reparametrized as a Vector Error Correction Model (VECM). This specification is particularly appropriate for macroeconomic systems in which output, inflation, exchange rates, debt, and commodity prices are jointly determined, exhibiting both long-run equilibrium relationships and short-run adjustment dynamics (Engle & Granger, 1987; Johansen, 1988).

3.1 Econometric specification

The long-run growth model was specified as:

$$\ln GDP_t = \beta_0 + \beta_1 CPI_t + \beta_2 LFPR_t + \beta_3 \ln EXR_t + \beta_4 \ln COPSUP_t + \beta_5 HCI_t + \beta_6 PG_t + \beta_7 \ln GS_t + \beta_8 \ln ED_t + \beta_9 \ln COP_t + \beta_{10} CBPR_t + \varepsilon_t$$

Where:

$\ln GDP_t$ = natural logarithm of real gross domestic product;

CPI_t = consumer price index / inflation indicator;

$LFPR_t$ = labour force participation rate;

$\ln EXR_t$ = natural logarithm of exchange rate;

$\ln COPSUP_t$ = natural logarithm of copper supply;

HCI_t = human capital index;

PG_t = population growth;

$\ln GS_t$ = natural logarithm of government spending;

$\ln ED_t$ = natural logarithm of external debt;

$\ln COP_t$ = natural logarithm of copper price;

$CBPR_t$ = central bank policy rate; and

ε_t = stochastic error term.



Let the endogenous variable vector be defined as:

$$Z_t = [InGDP_t, CPI_t, LFPR_t, InEXR_t, InCOPSUP_t, HCI_t, PG_t, InGS_t, InED_t, InCOP_t, CBPR_t]$$

The unrestricted VAR(p) system is given by:

$$Z_t = A_1Z_{t-1} + A_2Z_{t-2} + \dots + A_pZ_{t-p} + \mu + \mu_t$$

Since the variables are integrated of order one and cointegrated, the VAR is transformed into a VECM:

$$\Delta Z_t = \Pi Z_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Z_{t-i} + \mu + \mu_t$$

Where:

$$\Pi = \alpha\beta'$$

Here, α is the matrix of speed-of-adjustment coefficients, β is the matrix of long-run cointegrating coefficients, and Γ_i is the matrix of short-run dynamic coefficients.

The specific GDP equation can be written as:

$$\begin{aligned} \Delta InGDP_t = & \lambda_1 ECT_{t-1} + \sum_{i=1}^{p-1} \phi_{1i} \Delta InGDP_{t-i} + \sum_{i=1}^{p-1} \phi_{2i} \Delta CPI_{t-i} + \sum_{i=1}^{p-1} \phi_{3i} \Delta LFPR_{t-i} + \\ & \sum_{i=1}^{p-1} \phi_{4i} \Delta InEXR_{t-i} + \sum_{i=1}^{p-1} \phi_{5i} \Delta InCOPSUP_{t-i} + \sum_{i=1}^{p-1} \phi_{6i} \Delta HCI_{t-i} + \sum_{i=1}^{p-1} \phi_{7i} \Delta PG_{t-i} + \\ & \sum_{i=1}^{p-1} \phi_{8i} \Delta InGS_{t-i} + \sum_{i=1}^{p-1} \phi_{9i} \Delta InED_{t-i} + \sum_{i=1}^{p-1} \phi_{10i} \Delta InCOP_{t-i} + \sum_{i=1}^{p-1} \phi_{11i} \Delta CBPR_{t-i} + \mu_1 + \\ & \varepsilon_{1t} \end{aligned}$$

Where the error-correction term is:

$$\begin{aligned} ECT_{t-1} = & InGDP_{t-1} - \beta_0 - \beta_1 CPI_{t-1} - \beta_2 LFPR_{t-1} - \beta_3 InEXR_{t-1} - \beta_4 InCOPSUP_{t-1} - \beta_5 HCI_{t-1} \\ & - \beta_6 PG_{t-1} - \beta_7 InGS_{t-1} - \beta_8 InED_{t-1} + \beta_9 InCOP_{t-1} + \beta_{10} CBPR_{t-1} \end{aligned}$$

IV. FINDINGS & DISCUSSION

4.1 Unit-Root Tests

Table 1 presents the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit-root test statistics. The results confirm that the dependent variable ($InGDP_t$) and all stagflation-channel independent variables (CPI_t , $LFPR_t$, $InEXR_t$, $InCOPSUP_t$, HCI_t , PG_t , $InGS_t$, $InED_t$, $InCOP_t$ and $CBPR_t$) are non-stationary in levels but stationary after first differencing, establishing that the series are integrated of order one, $I(1)$. This property satisfies the precondition for cointegration analysis and justifies the adoption of the VECM framework.

Table 1

Unit-Root Test Summary

Variable	ADF level / p	ADF 1st diff / p	PP level / p	PP 1st diff / p	Order
$InGDP_t$	-1.232 / 0.9037	-3.076 / 0.0283	-1.067 / 0.9344	-6.278 / 0.0000	$I(1)$

Notes: Representative results are shown for $InGDP_t$; all major stagflation-channel variables exhibit the same $I(1)$ pattern. Critical values for the ADF and PP tests are based on MacKinnon (1996), and the table reports MacKinnon approximate p-values. All variables were tested under specifications including a constant and, where appropriate, a deterministic trend. The $I(1)$ property of both the dependent variable (real GDP) and the independent stagflation drivers (inflation, exchange-rate depreciation, labour-market conditions, copper supply, etc.) is consistent with the expectations-augmented Phillips Curve and the structuralist literature, which predict persistent non-stationarity under supply shocks and weak institutions in resource-dependent economies.

4.2 Cointegration Analysis

Table 2 reports the Johansen trace test results. The null hypothesis of no cointegration (rank = 0) is rejected at the 5 percent significance level, confirming the existence of at least one stable long-run equilibrium relationship among GDP and the stagflation-related variables.

Table 2*Johansen Cointegration Summary*

Rank	Trace statistic	5% critical value
0	312.45	239.23

Notes: The trace test statistics are compared against critical values from Johansen (1988) for an 11-variable system with a linear trend and intercept. Only the rank-0 result is shown for brevity; higher ranks were not rejected, indicating a single dominant cointegrating vector. Based on these results, the null hypothesis of no cointegration is rejected. This finding validates the VECM specification and supports the theoretical prediction of systematic long-run linkages between output and stagflation channels (exchange-rate volatility, labour-market weakness, commodity dependence) in Zambia (Sachs & Warner, 1995; Mehlum et al., 2006).

4.3 Long-Run Cointegrating Relationships

Table 3 presents the normalized long-run cointegrating vector with $\ln GDP_t$ as the dependent variable. Each coefficient represents the estimated marginal long-run effect of the corresponding independent variable on real GDP, holding all other variables constant.

Table 3*Long-Run Cointegrating Equation*

Variable	Coefficient	Std. Error	z-stat	p-value
CPI_t	0.0010623	0.00055	1.93	0.053
$LFPR_t$	-0.0780898	0.03092	-2.53	0.012
$\ln EXR_t$	-0.3491670	0.06564	-5.32	0.000
$\ln COPSUP_t$	-38.17698	3.697	-10.33	0.000
HCI_t	-0.2654126	0.52589	-0.50	0.614
PG_t	0.5383632	0.18777	2.87	0.004
$\ln GS_t$	-91.82534	2.026	-45.31	0.000
$\ln ED_t$	479.8081	12.772	37.57	0.000
$\ln COP_t$	0.0155935	0.03506	0.44	0.656

Notes: The vector is normalized on $\ln GDP_t$ (the dependent variable) and includes a constant term (not reported for brevity). Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors are heteroskedasticity- and autocorrelation-consistent (HAC). The strongly negative coefficients on $\ln EXR_t$, $LFPR_t$, $\ln COPSUP_t$, and $\ln GS_t$ directly quantify the long-run growth costs of exchange-rate depreciation, labour-market weakness, commodity dependence, and inefficient public spending, aligning with structuralist and resource-curse predictions (Olivera, 1964; Auty, 1990; Chikalipah, 2019). Positive coefficients on $\ln ED_t$ and PG_t suggest conditional growth-supporting roles for debt-financed investment and demographic demand, although these effects depend on policy quality and macroeconomic stability.

4.4 Short-Run Dynamics and Error-Correction Mechanism

Table 4 presents the short-run coefficients from the GDP equation of the VECM. The error-correction term (ECT_{t-1}) is negative and statistically significant at the 10 percent level, confirming convergence toward long-run equilibrium.

Table 4*GDP Short-Run VECM Equation*

Variable	Coefficient	Std. Error	z-stat	p-value
ECT_{t-1}	-0.0040843	0.00248	-1.65	0.099
$\Delta \ln GDP_t(-1)$	0.5603013	0.38075	1.47	0.141
$\Delta \ln CPI_t(-1)$	3.55e-06	0.00010	0.03	0.973
$\Delta \ln LFPR_t(-1)$	0.0012094	0.01664	0.07	0.942
$\Delta \ln GS_t(-1)$	-0.8943862	0.60100	-1.49	0.137
$\Delta \ln ED_t(-1)$	-13.34762	9.860	-1.35	0.176
Trend	-0.0457819	0.02542	-1.80	0.072
β_0	0.2054746	0.13829	1.49	0.137

Notes: Only the first lag is reported for brevity (optimal lag length $\setminus(p = 2\setminus)$ selected by AIC/SBIC). The ECT coefficient measures the speed of adjustment: approximately 0.41 percent of any disequilibrium is corrected per year. Most short-run differenced coefficients are statistically insignificant at conventional levels, indicating that the primary drivers of GDP dynamics operate through the long-run equilibrium and error-correction process rather than immediate lagged effects. HAC standard errors are used. These short-run patterns are consistent with the slow adjustment dynamics emphasized in the literature on commodity-dependent economies (Engle & Granger, 1987; Bruno & Easterly, 1998).

4.5 Dynamic Post-Estimation Analysis

To further understand the dynamic interactions among the variables and the transmission of stagflationary shocks to real GDP, impulse-response functions (IRFs), variance-decomposition analysis, and scenario simulations were conducted. These post-estimation diagnostics trace the response of $InGDP_t$ to one-standard-deviation orthogonalized shocks in the key stagflation channels over a 10-year horizon.

Table 5

Cumulative Impulse Responses of $InGDP_t$ to One-Standard-Deviation Shocks

Years	Shock to CPI_t (Inflation)	Shock to $InEXR_t$ (Exchange-Rate Depreciation)	Shock to $InCOP_t$ (Copper Price)
1	-0.0084	-0.0921	+0.0372
2	-0.0217	-0.1784	+0.0685
3	-0.0392	-0.2517	+0.0594
4	-0.0589	-0.3193	+0.0418
5	-0.0816	-0.3872	+0.0276
6	-0.0984	-0.4419	+0.0183
7	-0.1194	-0.4816	+0.0091
8	-0.1372	-0.5163	+0.0024
9	-0.1529	-0.5478	-0.0068
10	-0.1678	-0.5934	-0.0143

Notes: Responses are expressed as percentage changes in real GDP. The table presents cumulative responses derived from the estimated VECM using Cholesky decomposition (variable ordering: $InGDP_t$, CPI_t , $LFPR_t$, $InEXR_t$, $InCOPSUP_t$, HCI_t , PG_t , $InGS_t$, $InED_t$, $InCOP_t$, $CBPR_t$). A positive shock to CPI_t (inflation) and $InEXR_t$ (exchange rate depreciation) produces increasingly negative cumulative effects on GDP, consistent with cost-push and imported-input channels. A positive shock to $InCOP_t$ initially supports output, but the effect fades and becomes slightly negative over time; correspondingly, a negative copper-price shock would be expected to generate output losses over the forecast horizon. Standard errors are omitted for brevity.

Table 6

Variance Decomposition of Forecast-Error Variance of $InGDP_t$

Years	Shock to CPI_t (Inflation)	Shock to $InEXR_t$ (Exchange- Rate Depreciation)	Shock to $InCOP_t$ (Copper Price)	Other Shocks
1	4.2 (1.8)	12.7 (3.4)	3.1 (1.5)	80.0
2	7.8 (2.4)	18.4 (4.1)	5.6 (2.2)	68.2
3	11.3 (2.9)	22.9 (4.6)	7.2 (2.7)	58.6
4	13.9 (3.2)	25.6 (4.9)	8.4 (3.0)	52.1
5	15.7 (3.5)	27.8 (5.1)	9.1 (3.2)	47.4
6	17.2 (3.7)	29.4 (5.3)	9.6 (3.4)	43.8
7	18.4 (3.9)	30.7 (5.4)	9.9 (3.5)	41.0
8	19.5 (4.0)	31.8 (5.5)	10.1 (3.6)	38.6
9	20.4 (4.1)	32.6 (5.6)	10.2 (3.6)	36.8
10	21.3 (4.2)	33.4 (5.7)	10.3 (3.7)	35.0

Notes: Percentage contributions of each shock are reported, with standard errors in parentheses. Variance decomposition is based on the same Cholesky ordering as the IRFs. The table shows the proportion (in percent) of the forecast-error variance of $InGDP_t$ attributable to each shock at different horizons. Standard errors are computed using Monte Carlo simulations (1,000 replications). By year 10, shocks to inflation (CPI_t) and exchange-rate depreciation ($InEXR_t$) jointly explain approximately 54.7 percent of GDP forecast-error variance, confirming their central role in driving output fluctuations. Copper-price shocks contribute a more modest but persistent share.

Scenario simulations further show that a 30 percent copper-price collapse reduces GDP by more than 1.5 percent in the medium term; when compounded with rising debt-service costs, projected losses approach 3 percent. These dynamic results reinforce the empirical literature on inflation crises (Bruno & Easterly, 1998) and commodity-price transmission in Zambia (Chikalipah, 2019; Chipili, 2013), while demonstrating that stagflationary shocks are not only statistically significant but also economically meaningful and long-lasting.

4.6 Historical Consistency of the Model

The Vector Error Correction Model (VECM) results align closely with Zambia's major stagflationary episodes, including the oil and copper price shocks of the 1970s, the hyperinflation of the 1980s and 1990s, the 2015 exchange-rate crisis, and the disruptions caused by COVID-19 pandemic. This suggests that a combination of factors, such as currency depreciation, a weak job market, reliance on commodities, and insufficient government spending, have

consistently hindered economic growth. This historical agreement supports the model's ability to capture both the long-term structural limits and the short-term adjustment difficulties found in existing literature.

4.7 Discussion

The empirical results obtained from the Vector Error Correction Model provide robust evidence that stagflation exerts a significant and structurally persistent negative influence on Zambia's real GDP growth. This study examines the impact and relationships among these factors by modeling the dependent variable, the natural logarithm of GDP at time t ($\ln GDP_t$) alongside ten important stagflation-channel independent variables within a single cointegrated system. This approach directly addresses the significant deficiency highlighted in the literature review, which often isolates inflation, exchange rates, debt, labour-market dynamics, and commodity dependence in its examinations. In the long-run cointegrating relationship, exchange-rate depreciation ($\ln EXR_t$) displays the strongest negative and highly significant coefficient (-0.349). This finding directly confirms the structuralist prediction that, in an import-dependent economy, currency weakness raises the domestic cost of essential intermediate inputs such as fuel, machinery, and fertilizer, fuels cost-push inflation, and erodes competitiveness, thereby suppressing output (Olivera, 1964; Chipili, 2013). The result is consistent with Zambia-specific evidence showing that exchange-rate volatility has historically transmitted external shocks into domestic macroeconomic instability.

Labour-market fragility, as indicated by the Labour Force Participation Rate ($LFPR_t$), also has a negative and statistically significant impact (-0.078). This finding supports the expectations-augmented Phillips Curve model (Friedman, 1968; Phelps, 1967). This is consistent with the expectations-augmented Phillips Curve, under which supply-side constraints and labour-market rigidities weaken any stable trade-off between inflation and unemployment. Within the Zambian context, limited formal employment opportunities and pervasive informality diminish aggregate demand and productive capacity, thereby solidifying a stagflationary equilibrium instead of fostering inflation-driven growth. Moreover, the large negative coefficient for copper-supply dependence ($\ln COPSUP_t = -38.18$), supports the resource-curse hypothesis. Narrow reliance on a single primary commodity amplifies boom-bust cycles, discourages diversification, and transmits volatility directly into fiscal revenue, exchange rates, and inflation, precisely as theorized by Auty (1990), Sachs and Warner (1995), and Mehлум et al. (2006). This result extends Chikalipah's (2019) VAR-based findings on copper-price shocks by demonstrating that even the physical supply of copper, rather than price alone, exerts a drag on long-run GDP when diversification is absent. It also aligns with broader evidence that commodity price cycles in Africa are closely linked to output volatility, exchange-rate movements, and fiscal instability (Cashin et al., 2002).

Government spending ($\ln GS_t$), carries a strongly negative sign (-91.83), indicating that historically procyclical or inefficient public expenditure has crowded out private investment and exacerbated macroeconomic instability. This does not suggest that public expenditure is intrinsically detrimental; instead, it aligns with the fiscal-vulnerability literature, which indicates that in resource-rich developing nations, the advantages of potential growth are often outweighed by inadequate targeting and consumption financed through debt (Serven & Solimano, 1993; Reinhart & Rogoff, 2009). This observation corroborates Bruno and Easterly's (1998) assertion that macroeconomic instability, frequently exacerbated by unsustainable fiscal expansions, impedes long-term growth. Conversely, the long-run coefficients for external debt ($\ln ED_t$) and population growth (PG_t) are both positive and statistically significant. These results suggest that output can be increased through debt-financed infrastructure and the demand generated by population growth, assuming these resources are used efficiently. However, the short-run VECM dynamics and scenario simulations caution that these benefits are highly conditional: rising debt-service costs under exchange-rate stress quickly turn the net effect negative, consistent with the dual character of debt highlighted in the Zambian context (Chirwa et al., 2015).

The error-correction term (-0.0040843) is negative and statistically significant (albeit at the 10 percent level), confirming convergence to long-run equilibrium. Its extremely small absolute value implies, however, that the annual speed of adjustment is only about 0.41 percent. This slow adjustment process highlights the structural inflexibilities, limited diversification, and institutional weaknesses often found in economies that depend on commodities (Engle & Granger, 1987; Johansen, 1988). The coefficients obtained from short-run differencing are largely insignificant when considered individually, suggesting that the impact of immediate lagged variables is comparatively weak when contrasted with the long-run equilibrium influences. This finding is consistent with the enduring characteristics of stagflationary periods observed in Zambia's history. Dynamic post-estimation diagnostics further enrich the interpretation. Such dynamic analysis is particularly useful in macroeconomic systems characterized by persistence, feedback effects, and delayed transmission, as emphasized in the VAR and VECM literature (Frankel, 2012).

Impulse-response functions show that inflation and exchange-rate shocks generate cumulative negative GDP effects over a ten-year horizon, while variance decomposition attributes a substantial share of GDP forecast-error variance to these two volatility channels. Scenario simulations demonstrate that a 30 percent copper-price decline alone can reduce GDP by more than 1.5 percent in the medium term; when compounded with debt-service pressures, projected

losses approach 3 percent. These quantitative magnitudes align closely with Bruno and Easterly's (1998) cross-country evidence on inflation crises and with Chikalipah's (2019) Zambia-specific copper-price transmission findings, yet they go further by quantifying the joint, system-wide impact within one cointegrated framework.

Finally, the model's historical consistency is striking. The estimated relationships successfully replicate the macroeconomic patterns observed during the 1970s oil and copper-price shocks, the 1980s to 1990s hyperinflationary crisis, the 2015 twin shocks, and the COVID-19 disruptions. In each episode, exchange-rate depreciation, labour-market slack, commodity dependence, and inefficient fiscal responses interacted to suppress GDP, validating the VECM's ability to capture both the structural long-run constraints and the short-run adjustment frictions emphasized throughout the theoretical and empirical literature. Taken together, these findings show that stagflation in Zambia is a persistent structural condition rather than a temporary macroeconomic disturbance. The unified cointegrated approach demonstrates that the individual channels identified in prior studies are not independent; they reinforce one another through cost-push, expectation, and resource-curse mechanisms. This integrated evidence base fills the literature gap noted earlier and provides a stronger foundation for policy than single-equation or partial-equilibrium analyses. The slow speed of adjustment and the dominance of volatility channels imply that conventional stabilization policies alone are insufficient; sustained structural transformation is required to break the stagflationary trap.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study examined the effect of stagflation on Zambia's economic growth, measured by real gross domestic product (GDP), over the period 1964 to 2024. Employing a Vector Error Correction Model (VECM) that integrates multiple stagflation channels, exchange-rate movements, labour-market conditions, commodity dependence, inflation, fiscal variables, external debt, and monetary policy, the analysis confirms a stable long-run cointegrating relationship among the variables. The results indicate that stagflation in Zambia is not merely a temporary disturbance. Instead, it's a lasting structural issue that consistently hinders long-term economic growth.

Within the long-run cointegrating equation, exchange-rate depreciation is identified as a significant negative factor affecting GDP. The economy's considerable reliance on imported intermediate goods, coupled with the cost-push inflationary effects stemming from currency depreciation, is reflected in these findings. Moreover, deficiencies within the labour market, as evidenced by the labour force participation rate, also demonstrate a statistically significant negative influence. This observation is consistent with both the expectations in augmented Phillips Curve and structuralist viewpoints, which highlight supply-side limitations and underemployment prevalent in developing countries. The dependence on copper supply exhibits an even larger negative coefficient, thereby highlighting the resource-curse dynamics documented in existing research: a narrow export base exacerbates volatility without fostering sustained productivity improvements. Government expenditure exhibits a significant negative correlation, implying that historically, procyclical or poorly directed spending has displaced private sector activity and intensified macroeconomic volatility, rather than fostering expansion. Conversely, external debt and population growth are associated with positive long-run coefficients, which suggests that infrastructure funded by debt and demographic demand can, given suitable circumstances, positively influence output. Nevertheless, the short-run dynamics and scenario analyses highlight that these advantages are contingent upon effective debt management and productive investment strategies.

The error-correction term is negative but extremely small in magnitude (-0.0041), implying that only a negligible fraction of any disequilibrium is corrected annually. This sluggish adjustment speed highlights the persistence of stagflationary shocks in Zambia's structural environment. Impulse-response functions and variance-decomposition analyses further reveal that inflation shocks and exchange-rate volatility account for a substantial share of GDP forecast-error variance, while copper-price declines generate immediate and cumulative output losses, reaching more than 1.5 per cent in the medium term and approaching 3 per cent when compounded with debt-service pressures. These observed trends resonate with Zambia's historical instances of stagflation, including the oil and copper shocks of the 1970s, hyperinflation in the 1980s and 1990s, the twin crises of 2015, and the disruptions caused by the pandemic. This correlation supports the theoretical frameworks of the Phillips Curve's failure, structuralist cost-push models, and the resource-curse hypothesis, which is conditioned by institutional factors.

Consequently, the findings indicate that Zambia's stagflation stems from a combination of external vulnerabilities, institutional deficiencies, and an incomplete process of economic transformation. The sluggish approach to equilibrium and the prevalence of volatility channels suggest that traditional demand-management strategies are inadequate. Without proactive structural reforms, macroeconomic instability will likely continue, which will hinder economic growth, reduce purchasing power, and impede the nation's progress toward a more diverse and resilient economy. Therefore, this study contributes to both theory and practice by including various stagflation channels within a single, cointegrated framework. This provides a comprehensive basis for policy development in developing economies that depend on resources.

5.2 Recommendations

The empirical evidence presented in this study underscores the need for a coordinated macroeconomic and structural reform agenda that addresses the principal channels through which stagflation constrains growth. Policymakers should prioritize five interconnected pillars, each grounded in the long-run cointegrating relationships and short-run dynamics identified by the VECM. First, diversifying exports beyond copper is crucial for reducing the negative long-term effects of relying on copper and its price fluctuations. The Zambian government should broaden incentives for non-traditional exports, with a specific focus on agriculture, agro-processing, tourism, and light manufacturing. This can be achieved through strategic investments in value chains, the establishment of special economic zones, and the development of trade-facilitation infrastructure. These actions would lessen the impact of changes in commodity prices, stabilize foreign-exchange earnings, and gradually reduce the inflationary effects caused by currency depreciation.

Strengthening exchange-rate resilience should also be a central objective of macroeconomic policy. Given the significant negative coefficient associated with the nominal exchange rate, it is recommended for the Zambian Government, working through the Bank of Zambia (BoZ) to carefully accumulate international reserves, strengthen domestic financial markets to mitigate currency risk, and implement policies that foster stable and diversified foreign-exchange inflows. Furthermore, improved cooperation between monetary and fiscal authorities, supported by reliable inflation-targeting policies, will help stabilize expectations. This, in turn, will reduce the impact of currency depreciation on domestic prices and economic activity.

Moreover, improving the efficiency and productivity of public spending is crucial for lessening the negative long-term effects of government spending, as shown by the cointegrating vector. Reform initiatives should focus on redirecting funds toward investments that demonstrably boost productivity. This includes infrastructure projects, skill development programs, and agricultural methods that are designed to withstand climate change. At the same time, it's crucial to strengthen public investment management systems, improve spending controls, and conduct audits to ensure value for money. To reduce the negative effects of crowding out and lessen fiscal vulnerability, it's crucial to limit spending that increases during economic booms. This can be achieved by using fiscal rules that are set for the medium term and by putting in place regulations that counteract economic cycles. Therefore, managing external debt requires a more sophisticated approach. This approach should recognize the long-term benefits while also addressing the short-term challenges. Consequently, all new borrowing should be stringently tied to productive, revenue-generating initiatives, facilitated by transparent project appraisal and monitoring processes. The completion of current debt restructuring, along with the publication of regular debt-sustainability analyses and medium-term debt strategies, will strengthen policy credibility and reduce refinancing risks related to exchange-rate fluctuations.

Fifth, strengthening the labour market is necessary to address the statistically significant negative effects of a weak labour market. Labour market policies should prioritize the expansion of formal employment, skills development aligned with emerging sectors (agriculture modernization, manufacturing, and services), and the reduction of informality through targeted incentives for small and medium-sized enterprises. Demographic dividends from positive population growth can be realized only if human capital and labour absorption improve. Above all, these reforms must be implemented within an integrated policy framework that recognizes the systemic interactions among inflation, exchange rates, debt, fiscal policy, and commodity dependence. Isolated interventions are unlikely to succeed; instead, a whole-of-government approach, coordinated across ministries and supported by development partners, will be required to break the stagflationary feedback loops. Future research could improve the current Vector Error Correction Model (VECM) framework by including higher-frequency data, measures of institutional quality, or climate-related shocks. This would help improve policy recommendations for economies that depend on natural resources. If these recommendations are implemented effectively, Zambia could begin to transform its present vulnerabilities into a more resilient pattern of inclusive and sustained economic growth.

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