

Macroeconomic Stability: Drivers of Inflation in Angola

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Abstract

This study examines the drivers of inflation in Angola over the period 2015–2024 (120 observations), using an autoregressive distributed lag (ARDL) model. By integrating key macroeconomic variables such as the consumer price index (CPI), trade-weighted inflation (TCPI), nominal exchange rate (EXR), and money supply (M2), the research investigates both short-run dynamics and long-run equilibrium relationships. The analysis applies unit root tests and ARDL bounds testing to confirm cointegration among the variables and employs Granger causality tests to explore directional influences. Results indicate that inflation in Angola exhibits strong persistence with significant adjustment toward long-run equilibrium, while external shocks, particularly exchange rate fluctuations, play a critical role in influencing price levels. Monetary policy transmission and fiscal discipline appear to have limited immediate impact, suggesting that structural factors and reliance on oil revenues are major contributors to inflationary pressures. Based on these findings, the study recommends improvements in foreign exchange management, enhancement of domestic production capacity, diversification of the economy, and tighter fiscal controls.

Keywords: Inflation, ARDL model, monetary policy, Angola

DOI: 10.7176/JESD/16-2-03

Publication date: March 30th 2025

Introduction

Since gaining independence in 1975, Angola’s economy has experienced significant transformations, marked by socialist policies, civil war (1975–2002), and economic instability. According to Figure 1 below, post-war, from 2002 to 2014, Angola saw rapid oil-driven growth averaging 10 percent, enabling infrastructure development but deepening dependence on oil. The 2014 oil price collapse led to recession (2016–2020), currency depreciation, and inflation. Since 2018, reforms focusing on exchange rate liberalization, fiscal consolidation, and diversification have stabilized the economy, though structural challenges persist. The economy rebounded modestly in a post-recession, growing 4.4 percent in 2024, a fourth-year consecutive growth, averaging 2.4 percent, but oil remains central to Angola’s economy, accounting for about 29 percent of GDP, 59 percent of government revenues, and 94 percent of exports (INE, Ministry of Finance of Angola and BNA). Nevertheless, diversification efforts are yielding results, as agriculture is regaining its position as the primary driver of non-oil GDP, fuelled by increased credit to the agricultural sector (Caetano Joao *et al.* 2023, Caetano Joao 2024).

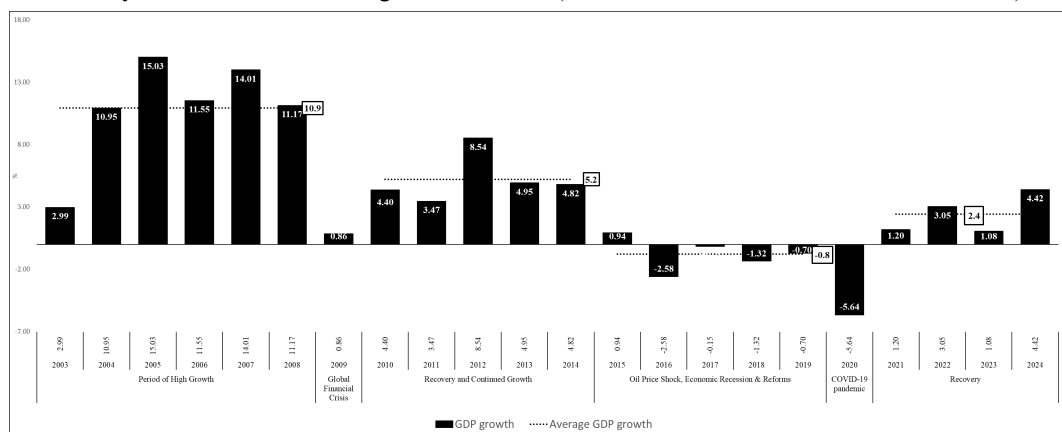


Figure 1: GDP performance

Inflation in Angola has historically been volatile due to war, economic transitions, and external shocks. The country faced hyperinflation in the 1990s, exceeding 4,000 percent, driven by excessive money printing and fiscal mismanagement. Post-war reforms and oil revenue stabilization helped reduce inflation, which fell from 430 percent in 2000 to around 12 percent in 2006. Monetary policy has played a crucial role in inflation control. The "hard kwanza" policy introduced in 2003, involving exchange rate stabilization and foreign financing of deficits, helped control inflation. From 2003, tighter monetary policy reduced inflation, but persistent money growth, remonetization, and reserve accumulation kept inflation dynamics unstable.

The 2014 oil crisis and exchange rate depreciation led to inflation exceeding 36 percent in 2016–2017. Figure 2 shows Angola’s monthly inflation (month-on-month, MoM) trajectory from January 2015 to October 2024. Inflation peaked at 4.26 percent in July 2016, likely due to currency depreciation and economic instability. From 2017 to 2021, inflation remained volatile but relatively stable. A sharp decline occurred in early 2022, reaching 0.07 percent, possibly due to policy interventions. Inflation rebounded in 2023, peaking before settling at 1.70 percent in late 2024. The trend reflects inflationary pressures, economic adjustments, and policy impacts over time.

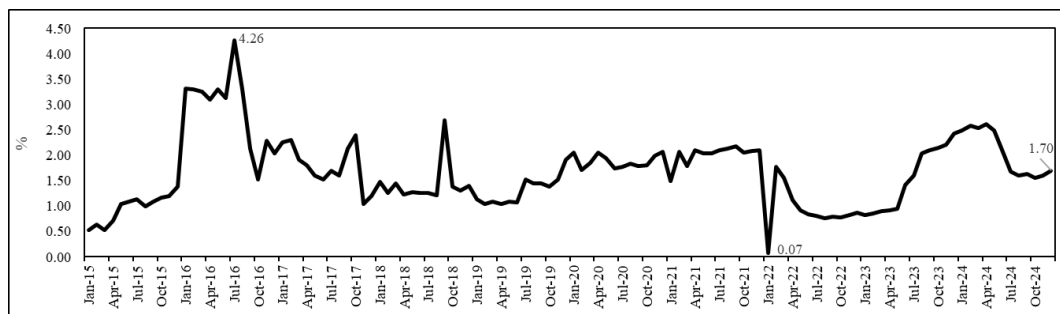


Figure 2: Monthly inflation (MoM) trajectory in Angola

The relationship between money growth and inflation has been complex. Before 2015, Angola relied on foreign reserves to stabilize prices through exchange rate management. However, declining oil revenues forced a shift toward tighter monetary policies. Money supply fluctuations were notable, with growth peaking at 29 percent in 2021. Periods of excessive money growth, particularly in 2019 and 2020, may have contributed to inflation acceleration.

Angola’s fiscal policy has improved since 2000, with government expenditures declining from 60 percent of GDP in 2000 to 35 percent in 2008. However, spending increased post-2007, leading to a rising non-oil primary deficit. Inflation remains sensitive to global commodity prices, exchange rate movements, and fiscal discipline.

Looking at the variables considered for this study, Figure 3 shows weak correlations between CPI and M2 (–0.0237) and EXR (–0.1052), while TCPI has a significant negative correlation (–0.3052, $p = 0.0007$). Figure 4 confirms no strong relationship between inflation and M2. Figure 5 shows a weak link between CPI and EXR. Figure 6 highlights a negative trend between inflation and TCPI. These weak linear associations suggest further analysis using an econometric model to capture lagged effects.

	CPI	TCPI	EXR	M2
CPI	1.0000			
TCPI	-0.3052 0.0007 *	1.0000		
EXR	-0.1052 0.2529	-0.0380 0.6802	1.0000	
M2	-0.0237 0.7972	-0.0254 0.7831	0.6543 0.0000 *	1.0000

Figure 3: Pearson correlation coefficients

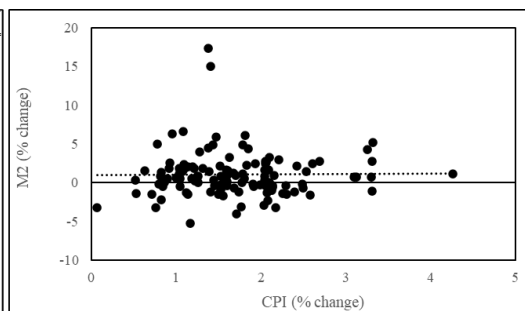


Figure 4: Relationship between inflation and M2

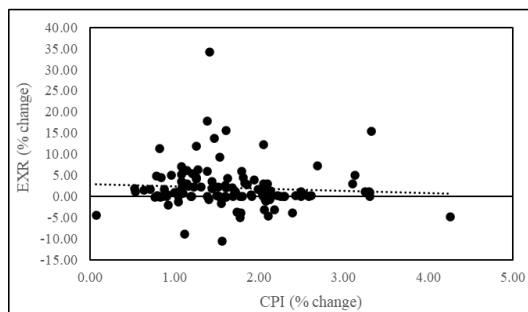


Figure 5: Relationship between inflation and EXR

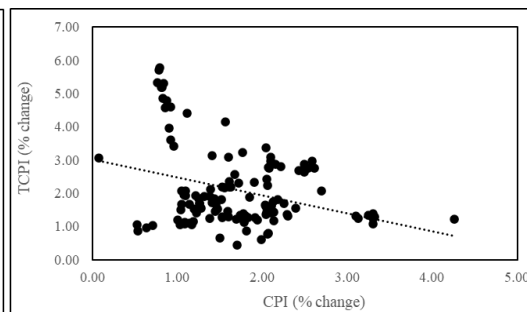


Figure 6: Relationship between inflation and TCPI

Hence, this study proposes to quantify the impact of the determinants of inflation in Angola and to propose what policy measures might help ensure stable prices in Angola.

Research questions

This research seeks to answer the following research questions:

- (i) Which independent variables contribute the most to inflation in Angola?
- (ii) What policy recommendations are necessary to help mitigate the impact of independent variables on inflation in Angola?

Research objectives

This research primarily aims to analyze and measure the relationship between inflation and identified determinants in Angola. Using an autoregressive distributed lag (ARDL) model and subsequent diagnostic tests, the study evaluates the significance of these factors in influencing inflation over both short- and long-term horizons, while also identifying the direction of causality. Understanding the bidirectional link between inflation and selected variables is essential for formulating effective monetary policy in Angola. Furthermore, this study seeks to explore similar findings and policy recommendations from international experiences through an in-depth literature review.

Hypothesis

The null and alternative hypotheses will be examined in line with this study's objectives to assess whether the identified variables influenced inflation between 2015 and 2024:

- H0: Inflation in Angola is determined by the variables; and
- Ha: Inflation in Angola is not determined by the variables.

The hypotheses will be evaluated at a 5 percent significance level for both short- and long-term relationships. If the probability associated with the t-value is greater than the significance level, the null hypothesis will be retained. However, if the probability of the t-value is less than the significance level, the null hypothesis will be rejected.

Significance of the research

The uniqueness of this study lies in the fact that no previous research has examined the determinants of inflation in Angola for the period 2015–2024, nor has imported inflation been considered as a contributing factor. The findings can aid Angolan policymakers in formulating more effective macroeconomic policies and implementing measures to stabilize prices, benefiting both the economy and society.

Literature Review

This section reviews theoretical and empirical literature on inflation determinants to better rationalize the monetary policy formulation. Various studies highlight domestic and external factors influencing inflation, leading to different but often similar conclusions. Key theories examined include monetary, structuralist, and quantitative theories of money. Understanding these determinants is essential for designing effective anti-inflationary policies to achieve price stability. The section also outlines the theoretical framework and

hypotheses tested in this study.

Generic studies on Inflation Determinants

Inflation has been widely studied in economic literature, with various theoretical frameworks explaining its determinants.

The classical view, based on Fisher's (1911) Quantity Theory of Money, suggests that inflation is primarily a monetary phenomenon. According to Friedman (1968), "inflation is always and everywhere a monetary phenomenon," implying that money supply growth exceeding economic growth leads to inflation. Empirical studies such as McCandless and Weber (1995) confirm a strong long-run relationship between money supply and inflation.

Keynesian models argue that inflation results from excessive demand in the economy. The Phillips Curve suggests a trade-off between inflation and unemployment in the short run (Phillips 1958). Blanchard and Fischer (1989) expanded on this by considering expectations and wage-setting behavior. Gordon (1988) supports that cost-push inflation arises from supply-side shocks, such as rising input costs. Factors such as oil price shocks as described by Hamilton (1983) and exchange rate pass-through examined by Taylor (2000) contribute to inflationary pressures. Structuralists such as Chenery and Syrquin (1975) emphasize supply-side constraints, such as weak infrastructure and market rigidities, in driving inflation, especially in developing economies. The New Keynesian model by Clarida, Galí and Gertler (1999) integrates expectations, rigidities, and policy credibility, highlighting the role of central banks in anchoring inflation expectations.

Inflation can be influenced by exchange rate fluctuations and external trade dynamics. Studies such as Dornbusch (1976) and Rogoff (1996) emphasize the impact of currency depreciation on inflation through import prices. The Balassa (1964) and Samuelson (1964) effect suggests that inflation differentials between countries can be explained by productivity differences in tradable versus non-tradable sectors.

Empirical Studies on Inflation in Africa

In Sub-Saharan Africa, studies from Ajayi and Khan (2000), and Kilindo (1997) confirm the role of monetary expansion as a key driver of inflation. In West Africa, Ghana and Nigeria have experienced inflation due to excessive public spending and central bank financing of deficits as concludes Amoah & Mumuni (2019), and Oyejide (1972).

Fielding (2008) proves that many African economies are import-dependent, making exchange rate fluctuations a crucial determinant of inflation. Furthermore, studies on Nigeria from Olomola and Adejumo (2006) and Ghana from Bawumia (2010) show strong exchange rate pass-through to domestic prices. Collier and Gunning (1999) argue that terms-of-trade shocks, such as commodity price fluctuations, exacerbate inflation volatility in resource-rich economies.

Mkenda (2001) and Ndulu et al. (2007) highlight how poor infrastructure, supply chain inefficiencies, and weak market integration contribute to persistent inflation in Africa and Timmer (2009) further argues that food price inflation is particularly relevant, as agriculture-dependent economies experience inflation due to supply shocks.

Case Studies on Inflation in Angola

Angola has experienced persistent inflation over the years, influenced by structural constraints, monetary policies, fiscal imbalances, and external shocks. Several studies have analyzed the determinants of inflation in Angola, focusing on different periods and policy regimes.

Ferreira (2006) studied Angola's inflationary trends during the post-civil war period (2002–2006) and found that excessive money supply growth, coupled with weak monetary policy transmission, fuelled inflation. The International Monetary Fund (IMF 2016) identified high exchange rate pass-through as a major driver of inflation in Angola due to the country's heavy reliance on imports, as depreciation of the Kwanza (AOA) significantly increases domestic prices. Alves and Silva (2018) used a VAR model to assess the relationship between money supply (M2), exchange rate fluctuations, and inflation in Angola. Their findings confirm that monetary expansion and depreciation of Kwanza contribute to inflationary pressures.

Martins (2015) examined the impact of fiscal policies on inflation in Angola, highlighting the role of fiscal deficits and public sector wage increases in driving inflation, while Sobrinho and Mano (2019) argue that inflation in Angola is closely linked to government spending and public debt dynamics, as the government finances deficits through central bank borrowing, inflationary pressures increase. World Bank (2021) found that Angola's inflation spikes often coincide with fiscal expansion, especially during election cycles.

The United Nations Conference on Trade and Development (UNCTAD 2020) noted that Angola's import

dependency leads to structural inflation, as price fluctuations in global markets directly impact domestic prices, while Barros and Ramos (2017) highlighted how weak domestic production capacity in the agriculture and manufacturing sectors exacerbates inflation by limiting local supply and increasing reliance on costly imports. Furthermore, Bastos and Domingos (2019) studied food price inflation in Angola, emphasizing the role of logistical challenges, poor infrastructure, and supply chain inefficiencies in keeping food prices high.

Ferreira and Neto (2013) linked Angola’s inflation volatility to oil price fluctuations, showing that revenue declines from falling oil prices often result in currency depreciation and inflation spikes and Banco Nacional de Angola (2022) emphasized that inflation in Angola tends to rise when oil prices fall due to the impact on foreign exchange reserves and currency stability.

Research Structure and Methodology

Data sources, estimation period and econometric tool

The high frequency data used to estimate the time series in the present study were extracted from the Angola Statistical Office (INE) and the National Bank of Angola (BNA). For the inflation rates from the top 20 trading partners, data was extracted from the Federal Reserve Bank of St. Louis (FRED). The time series data are monthly, covering the period from 2015 to 2024, a total of 120 observations.

For the estimation exercise, the STATA 14.2 econometric tool was used.

Selection of variables

The selection of variables was guided by a combination of theoretical insights, empirical evidence, data availability, and statistical methods, all aligned with the research question and literature review. Data for four variables were collected, as shown in Figure 7 below.

Table 1. Summary of dependent and independent variables used in the study

Variables	Definition	Measurement	Source	Expected relationship
CPI	Inflation, consumer prices. Percentage change in the price of a basket of goods and services consumed by households	MoM change (%)	INE	Dependent
TCPI	Trade inflation. Proxy for import-weighted inflation rate from top 20 trading partners of Angola.	MoM change (%)	FRED	Positive
EXR	Nominal exchange rate. Percentage change of the price of the Angolan local currency kwanza in terms of US dollar.	MoM change (%)	BNA	Positive
M2	Money supply. Defined as M1, currency in circulation, like banknotes and coins and Demand deposits at commercial banks plus time and savings deposits.	MoM change (%)	BNA	Positive

Research methodology and model design

The objective of this research is to assess the underlying causes of inflation in Angola using the ARDL econometric model. To verify the existence of the relationship between the variables in the model, the following hypotheses were raised:

- H0: Inflation in Angola is mainly determined by the variables; and
- Ha: Inflation in Angola is not mainly determined by the variables.

The methodology used to quantify the effect of different independent variables on inflation using an ARDL model was as follows:

- Conducting the Augmented Dickey Fuller (ADF) unit root test to check the stationarity of variables. For the test, the basic equation applied by Nkoro et al. (2016) involves estimating the following regression equation:

$$\Delta Y_t = \alpha_0 + \rho_1 Y_{t-1} + \sum_{i=1}^k \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

where ΔY_t represents the change in the dependent variable at time t , α_0 represents the constant term (intercept);

$\rho_1 Y_{t-1}$ represents the lagged level of the dependent variable; $\sum_{i=1}^k \alpha_i \Delta Y_{t-i}$ is the sum of the lagged differences in the dependent variable, capturing the short-term dynamics; and ε_t is the error term (white noise);

- (i) Selecting the optimal lag length for the ARDL model using the Akaike Information Criterion (AIC) and specifying the long-term ARDL model equation:

$$CPI_t = \alpha_0 + \sum_{i=1}^{p_1} \beta_i CPI_{t-i} + \sum_{j=1}^{p_2} \beta_j TCPI_{t-k} + \sum_{k=1}^{p_3} \beta_k EXR_{t-l} + \sum_{l=1}^{p_4} \beta_l M2_{t-m} + \varepsilon_t \quad (2)$$

- (ii) Estimating the short-term relationship and adding the error correction term, which is that of the long-term regression but lagged for a period:

$$\varepsilon_{t-1} = X_t - \beta_0 - \beta_1 M_{t-1} \quad (3)$$

$$\Delta X_t = \beta_0 + \beta_1 \Delta M_t + \beta_2 \varepsilon_{t-1} + v_t \quad (4)$$

where ΔX_t represents the change in the dependent variable X_t between two time periods. The difference operator (Δ) typically indicates a first difference; β_0 is the intercept term or constant; ΔM_t is the change in the independent variable M_t and β_1 is the coefficient that measures the effect of this change on the dependent variable X_t ; $\beta_2 \varepsilon_{t-1}$ is the key term in ECM, ε_{t-1} represents the lagged error correction term and β_2 represents the speed of adjustment toward long-term equilibrium.

- (iii) Performing the bounds testing for cointegration and estimating the long-term relationship, as well as the short-term dynamics, using the error correction model (ECM);

- (iv) Conducting a series of diagnostic tests to validate the model:

Jarque-Bera test (Normality of residuals)

$$JB = \frac{n}{6} \left(S^2 + \frac{(K-3)^2}{4} \right) \quad (5)$$

where n is the sample size; S is the sample skewness; and K is the sample kurtosis.

Multicollinearity test

$$VIF = \frac{1}{1-R_j^2} \quad (6)$$

where R_j^2 is the R-squared value obtained by regressing the j -th predictor on all other predictors.

Breusch-Godfrey LM test (Serial correlation)

$$\hat{u}_t = \alpha_0 + \alpha_1 X_{1t} + \alpha_2 X_{2t} + \dots + \rho_1 \hat{u}_{t-1} + \rho_2 \hat{u}_{t-2} + \dots + \rho_p \hat{u}_{t-p} + \varepsilon_t \quad (7)$$

where, \hat{u}_{t-i} denotes the lagged residuals; α_i represents the regression coefficients; p is the number of restrictions imposed by H_0 , and ε_t is the white noise error term in the auxiliary regression that satisfies all the classical assumptions.

Breusch-Pagan test (Heteroscedasticity)

$$y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} + \varepsilon_i \quad (8)$$

where y_i is the dependent variable; $X_{1i}, X_{2i}, \dots, X_{ki}$ are independent variables, $\beta_0, \beta_1, \dots, \beta_k$ are the coefficients to be estimated, and ε_i denotes the residuals (errors).

CUSUM test (Stability)

$$CUSUM(t) = \sum_{i=1}^t \omega_i \quad (9)$$

where ω_i represents the recursive residuals. The cumulative sum is plotted over time to monitor the stability of the parameters.

Granger causality test

$$Y_t = \alpha_0 + \sum_{i=1}^p \alpha_i Y_{t-i} + \sum_{j=1}^q \beta_j X_{t-j} + \varepsilon_t \quad (10)$$

where, Y_t is the dependent variable; X_t is the independent variable whose past values are being tested for predictive power; α_0 is the intercept, α_i denotes the coefficients for the lagged values of Y ; β_j denotes the coefficients for the lagged values of X ; ε_t is the error term; and p and q are the maximum lags for Y and X ,

respectively.

Data, Estimation Results and Discussion

Table 2 presents the descriptive statistics for the variables involved, each with 120 observations. CPI and TCPI show moderate variability, with TCPI having a higher mean and standard deviation, indicating greater dispersion. EXR exhibits the highest variability, with a wide range (26.67) and significant standard deviation (5.18), suggesting volatile fluctuations. M2 also shows considerable variability but less extreme than EXR. Median values are lower than means for all variables, indicating right-skewed distributions. Overall, EXR appears the most volatile, while CPI is the most stable.

Table 2. Descriptive statistics results

Variables	Obs.	Mean	Median	St. Dev	Min	Max	Diff.
CPI	120	1.69657	1.60721	0.68654	0.53000	3.32061	2.79061
TCPI	120	2.10430	1.68444	1.20191	0.60641	5.71285	5.10644
EXR	120	1.96478	0.84223	5.18371	-8.87383	17.79592	26.66975
M2	120	1.03079	0.69031	2.94481	-3.97560	15.02296	18.99856

Optimal lag selection

Based on the information criterion results, the AIC was determined to be the most suitable, as it had the lowest value. The findings indicate that the optimal lag selection for each variable in the ARDL model is 1, 4, 2, and 0 for CPI, TCPI, EXR, and M2, respectively.

The equation would take the following shape:

$$CPI_t = \alpha_0 + \sum_{i=1}^1 \beta_i CPI_{t-i} + \sum_{j=0}^4 \delta_j TCPI_{t-j} + \sum_{k=0}^2 \eta_k EXR_{t-k} + \lambda_0 M2_{t-l} + \varepsilon_t \quad (11)$$

Unit root tests

Tables 3 and 4 present the ADF and PP unit root tests, assessing stationarity with and without trend. Results indicate mixed integration orders, with CPI, EXR, and M2 exhibiting I(0) and I(1) properties, while TCPI is strictly I(1). These findings justify ARDL modeling, accommodating both I(0) and I(1) variables.

Table 3. ADF and PP unit root tests with intercept

Variables	Augmented Dickey Fuller			Phillips-Perron		
	t-Statistic at level	t-Statistic 1st Diff.	Level of Integration	t-Statistic at level	t-Statistic 1st Diff.	Level of Integration
CPI	-3.202	-8.809	I(0); I(1)*	-3.427	-12.188	I(0); I(1)*
TCPI	-1.336	-4.534	I(1)*	-1.239	-5.587	I(1)*
EXR	-6.643	-11.832	I(0); I(1)*	-6.976	-13.110	I(0); I(1)*
M2	-6.531	-12.786	I(0); I(1)*	-10.002	-20.021	I(0); I(1)*
Critical values	-3.504	-3.504	1% level*	-3.504	-3.504	1% level*
	-2.889	-2.889	5% level**	-2.889	-2.889	5% level**
	-2.579	-2.579	10% level***	-2.579	-2.579	10% level***

Table 4. ADF and PP unit root tests with intercept and trend

Variables	Augmented Dickey Fuller			Phillips–Perron		
	t-Statistic at level	t-Statistic 1st Diff.	Level of Integration	t-Statistic at level	t-Statistic 1st Diff.	Level of Integration
CPI	-3.221	-8.805	I(1)*	-3.430	-12.159	I(1)*
TCPI	-0.494	-4.666	I(1)*	-0.320	-5.722	I(1)*
EXR	-6.644	-11.781	I(0); I(1)*	-6.970	-13.052	I(0); I(1)*
M2	-6.502	-12.731	I(0); I(1)*	-9.958	-19.931	I(0); I(1)*
Critical values	-4.034	-4.034	1% level*	-4.034	-4.034	1% level*
	-3.448	-3.448	5% level**	-3.447	-3.448	5% level**
	-3.148	-3.148	10% level***	-3.147	-3.148	10% level***

ARDL bound tests results for Cointegration

As seen above, the series were integrated in different orders, that is, with a combination of I(0) and I(1) series; hence, the ARDL bounds test was applied to the level of the variables to determine whether the variables had a long-term cointegration.

Table 5. ARDL bounds testing

Significance level	H ₀ : no cointegration							
	accept if F < critical value for I(0) regressors				reject if F > critical value for I(1) regressors			
	L1		L05		L025		L01	
	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound
	[I(0)]	[I(1)]	[I(0)]	[I(1)]	[I(0)]	[I(1)]	[I(0)]	[I(1)]
k_3	2.72	3.77	3.23	4.35	3.69	4.89	4.29	5.61
F-statistic = 4.608								

Table 5 shows the ARDL bounds testing results. With an F-statistic of 4.608, the result exceeds the upper bound at the 5 percent significance level (4.35). This suggests strong evidence of cointegration, implying a long-run relationship among the variables at conventional significance levels, hence the null hypothesis of no cointegration is rejected. The ARDL model is retained.

ARDL model estimation results

The variables CPI, TCPI, EXR, and M2 exhibit cointegration, indicating the presence of a long-term equilibrium relationship. Consequently, both the long-term and short-term models were estimated to analyze their dynamics.

Long-term relationship

With the existence of a long-term relationship between variables, the model could quantify the effect of independent variables on the dependent variables, measuring the effect of the explanatory variables on the explained variable, as shown in Table 6 below.

Table 6. Long run estimation results

Dependent Variable: CPI						
Selected model: ARDL (1, 4, 2, 0)			Sample: 2015m5 – 2024m12			
Number of obs:	116			R-squared:	0.7061	
F(10, 105):	25.22			Adj R-squared:	0.6781	
Prob > F:	0.0000			Root MSE:	0.3782	
Variables	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
CPI (L1)	0.8097247	0.058628	13.81	0.000	0.6934763	0.9259731
TCPI (--)	0.0230681	0.1395528	0.17	0.869	-0.2536393	0.2997754
TCPI (L1)	-0.0281605	0.2557102	-0.11	0.913	-0.5351866	0.4788655
TCPI (L2)	0.1389663	0.3002126	0.46	0.644	-0.4562998	0.7342325
TCPI (L3)	-0.3083935	0.2982996	-1.03	0.304	-0.8998665	0.2830795
TCPI (L4)	0.1271008	0.1814898	0.70	0.485	-0.2327601	0.4869616
EXR (--)	0.0036854	0.0107274	0.34	0.732	-0.0175852	0.0249559
EXR (L1)	0.0072563	0.0088619	0.82	0.415	-0.0103151	0.0248278
EXR (L2)	0.0044351	0.007845	0.89	0.573	-0.0111201	0.0199903
M2	0.0151116	0.016934	2.56	0.374	-0.0184653	0.0486886
cons	0.3911471	0.1528126	-0.36	0.012	0.088148	0.6941462

The long-run estimation results indicate that CPI is highly persistent, with its lagged value (CPI L1) significantly influencing current inflation ($p < 0.01$). On the other hand, TCPI and EXR coefficients, including their lags, are statistically insignificant, suggesting no strong long-run impact on CPI. M2 also lacks statistical significance, implying a weak monetary influence. The model's R-squared (0.7061) suggests a good fit, but some explanatory variables contribute minimally. The insignificant constant indicates no strong autonomous inflationary pressures independent of included factors.

Short-term relationship

Despite confirming a long-term relationship, the ARDL model highlights the importance of short-term dynamics for immediate insights, predictive power, policy guidance, model accuracy, and economic theory alignment in econometric and time series analysis.

Table 7. Short run dynamics and error correction model results

Dependent Variable: dCPI

Selected model: ARDL (1, 4, 2, 0)			Sample: 2015m6 – 2024m12			
Number of obs:	115		R-squared:	0.6957		
F(9, 105):	2.41		Adj R-squared:	0.3361		
Prob > F:	0.0158		Root MSE:	4.0474		
Variables	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
dCPI (L1)	0.7017302	0.237656	2.95	0.004	0.2305023	1.172958
dTCPI (L1)	-0.0027609	0.1764372	-0.02	0.988	-0.3526033	0.3470815
dTCPI (L2)	0.1316152	0.1841183	0.71	0.476	-0.2334575	0.4966879
dTCPI (L3)	-0.2738401	0.1848941	-1.48	0.142	-0.640451	0.0927708
dTCPI (L4)	0.0471352	0.1847597	0.26	0.799	-0.3192091	0.4134794
dEXR (L1)	0.0064091	0.0069566	0.92	0.359	-0.0073845	0.0202027
dEXR (L2)	0.0040509	0.0064941	0.62	0.534	-0.0088258	0.0169275
dM2	0.0137105	0.0097744	1.40	0.164	-0.0056704	0.0330914
ECT	-0.9758473	0.256151	-3.81	0.000	-1.483747	-0.4679472
_cons	-7.244381	0.0353348	0.02	0.986	-0.0694373	0.0706874

According to short-run regression results in Table 7, the ARDL (1, 4, 2, 0) model indicates that past inflation significantly influences current inflation (lagged CPI coefficient: 0.702, $p = 0.004$), suggesting strong inflation persistence. This suggests inflation perception may drive inflation, as businesses and consumers adjust prices and wages based on past trends, reinforcing inflationary pressures. The error correction term (ECT) is -0.976 ($p = 0.000$), implying that deviations from long-run equilibrium adjust rapidly, with approximately 98 percent correction per period. External price movements (dTCPI) and exchange rate changes (dEXR) are statistically insignificant, indicating a minimal short-run impact on domestic inflation. Money supply changes (dM2) also lack immediate effect. The model is statistically significant ($p = 0.0158$) but explains only 34 percent of inflation variability (Adj. R-squared = 0.3361), suggesting other unaccounted factors influence inflation dynamics.

Results of the diagnostic tests

Using the approach described in chapter 3, diagnostic tests were conducted to assess (i) normality, (ii) autocorrelation, (iii) heteroscedasticity, and (iv) model stability.

Normality tests

Figure 7 presents the normality test for residuals. The Jarque-Bera statistic (48.038) and the high kurtosis (10.31) indicate significant deviation from normality. The skewness (1.03) suggests asymmetry, with a rightward tilt. The histogram confirms non-normal distribution, implying potential misspecification or the need for transformation in the model.

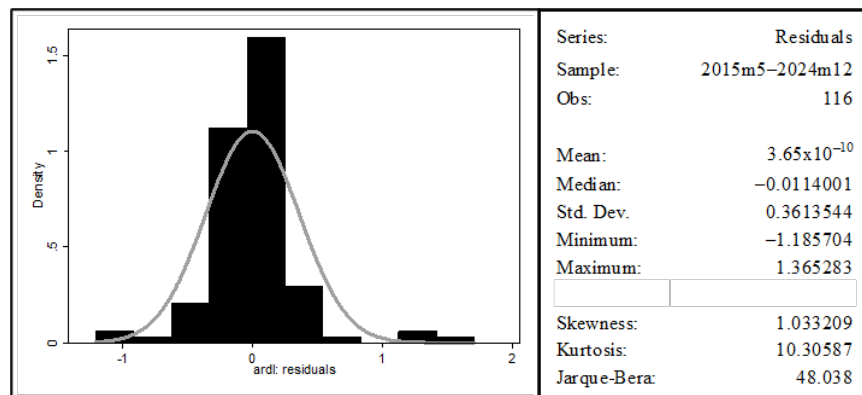


Figure 3: Normality test

Multicollinearity test

Table 8 presents the variance inflation factor (VIF) results, assessing multicollinearity among explanatory variables. The VIF values for TCPI (1.75), EXR (1.75), and M2 (1.00) are all below the conventional threshold of 10, indicating no severe multicollinearity. The mean VIF (1.50) further confirms that independent variables are not highly correlated, ensuring reliable coefficient estimates in the ARDL model. No corrective measures, such as variable exclusion or transformation, are required.

Table 8. VIF results

Variable	VIF	1/VIF
TCPI	1.75	0.571388
EXR	1.75	0.571846
M2	1.00	0.998554
Mean VIF	1.50	

Autocorrelation test

Table 9 presents the Breusch-Godfrey test for autocorrelation to check for serial correlation in the residuals. The chi-square statistic (0.962) with 1 degree of freedom yields a p-value of 0.3266, which is above the conventional 5 percent significance level. This means that the model does not suffer from autocorrelation issues, which is desirable for ensuring unbiased and efficient estimates.

Table 9. Breusch-Godfrey test for autocorrelation

lags (p)	chi2	degrees of freedom	Prob > chi2
1	0.962	1	0.3266

Heteroscedasticity test

Table 10 below shows the heteroscedasticity test results. Since the p-value of 0.9995 is greater than the 0.05 significance level, the null hypothesis was not rejected. Hence, it confirms homoscedasticity.

Table 10. White's test for heteroscedasticity

chi2	df	Prob > chi2
26.07	54	0.9995

Stability tests

The CUSUM test (Figure 8) shows that the model's residuals remain within the upper and lower bounds at a 5 percent significance level, suggesting no structural instability. However, the CUSUMSQ test (Figure 9) indicates possible instability, as the cumulative sum of squared residuals approaches the boundaries. This suggests

potential variance instability in the model over time, warranting further examination. While the model appears largely stable, some variations in the long-run variance may require adjustments or robust checks to ensure reliable inference.

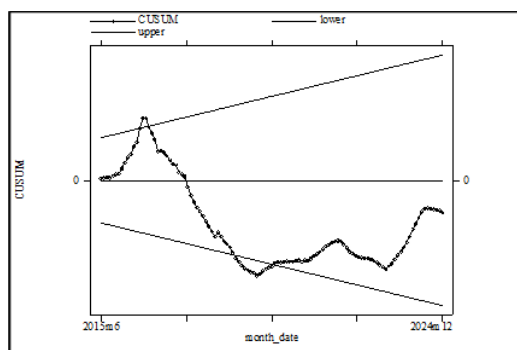


Figure 4: CUSUM test results

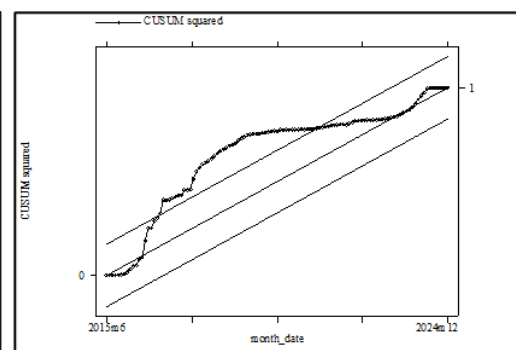


Figure 5: CUSUM of Squares test results

Causality analysis results

The Granger causality test results in Table 11 below indicate that CPI Granger-causes EXR at a 1 percent significance level, while no bidirectional causality exists between CPI, TCPI, EXR, and M2. Other relationships fail to reject the null hypothesis.

Table 11. Granger Causality Test

Null hypothesis	Equation	Excluded	chi2	df	Prob > chi2	Result
TCPI does not Granger-cause CPI	CPI	TCPI	2.3169	2	0.314	Accept the null hypothesis
CPI Granger-cause TCPI	TCPI	CPI	.08217	2	0.960	Accept the null hypothesis
EXR does not Granger-cause CPI	CPI	EXR	.07212	2	0.965	Accept the null hypothesis
CPI Granger-cause EXR	EXR	CPI	10.928	2	0.004	Reject the null hypothesis
M2 Granger-cause CPI	CPI	M2	2.8439	2	0.241	Accept the null hypothesis
CPI does not Granger-cause M2	M2	CPI	3.7129	2	0.156	Accept the null hypothesis

Discussion

The ARDL model offers new insights into Angola's inflation dynamics, reinforcing and extending prior research. Strong inflation persistence suggests inflation perception may be a key driver, as businesses and consumers adjust prices and wages based on past trends, supporting classical monetarist views. However, unlike traditional theories emphasizing money supply and fiscal deficits, the study findings indicate these factors (M2, TCPI) have limited short-run impact. Instead, exchange rate fluctuations play a crucial role, aligning with Ferreira (2006) and IMF reports, which highlight external shocks and currency depreciation as major determinants of domestic price movements.

Additionally, the weak statistical impact of fiscal measures echoes structuralist perspectives that stress the importance of underlying economic constraints, such as overdependence on oil revenues and insufficient domestic production. The discussion also emphasizes the role of monetary and fiscal policies in stabilizing inflation, suggesting that effective policy coordination is crucial for macroeconomic stability. Structural constraints, including weak domestic production capacity and limited financial inclusion, may exacerbate inflationary pressures. Furthermore, the findings are examined in the context of broader economic challenges, such as exchange rate pass-through effects and external debt sustainability. Thus, in contrast to the demand-pull and cost-push theories from Keynesian literature, the interplay between external variables and structural factors appears to dominate.

Conclusions

Summary conclusions

In this study, an ARDL approach was employed to examine the drivers of inflation in Angola, leveraging both short-run and long-run dynamics of key macroeconomic variables influencing price levels. Our empirical

findings highlight the significant influence of monetary factors, external shocks, and structural constraints on inflationary trends. The methodological rigor of ARDL allowed to capture the persistence of inflation and the speed of adjustment toward equilibrium.

It also revealed that monetary policy alone may be insufficient to control inflation without complementary fiscal measures. Structural weaknesses, such as limited domestic production and financial market inefficiencies, exacerbate inflationary pressures.

An optimal lag was selected, based on the AIC criterion, resulted in lags of 1 for CPI, 4 for TCPI, 2 for EXR, and 0 for M2, establishing the ARDL model structure. The ADF and PP unit root tests indicated mixed orders of integration among the variables, justifying the use of the ARDL methodology. Furthermore, the ARDL bounds test, where the F-statistic exceeds the critical value, confirmed cointegration and a stable long-term relationship. The long-term estimates reveal strong inflation persistence through significant lagged CPI effects, while short-term dynamics indicate that past inflation significantly influences current inflation, with a rapid error correction term adjusting nearly 98 percent of disequilibrium per period.

Subsequently, diagnostic tests affirmed normality, absence of multicollinearity, and no serial correlation, though the CUSUMSQ test hints at potential variance instability. Finally, in the Granger causality test it was revealed that CPI Granger-causes EXR, and the overall discussion in sub-chapter 4.7 emphasizes the need for coordinated policy actions to achieve price stability. Strengthening monetary policy transmission, improving foreign exchange management, and diversifying the economy are essential strategies to mitigate inflation risks. The study suggests enhancing domestic production capacity to reduce import dependency and implementing measures to stabilize the exchange rate. Fiscal discipline and improved public debt management are also critical for long-term stability. Overall, the research contributes to understanding inflation dynamics in resource-dependent economies, offering insights for policymakers.

On the other hand, the prevalence of a large informal economy in Angola (more than 80 percent of the population) could significantly impact the study's findings. Since many transactions in the informal sector are not captured by official statistics, key variables such as money supply (M2) and the consumer price index (CPI) might be undermeasured. This under-reporting can lead to measurement error, thereby weakening the estimated relationships in the ARDL model. For example, if a substantial portion of economic activity occurs outside formal channels, the official monetary aggregates may not fully reflect the actual liquidity available, potentially biasing the estimated impact of money supply on inflation.

Moreover, the informal sector often operates with different pricing mechanisms and may experience more volatile price adjustments compared to the formal sector. As a result, the official CPI may not capture the full extent of price fluctuations, leading to a divergence between measured inflation and the inflation experienced by the public. This divergence could intensify inflation perception among consumers, which, in turn, may influence wage-setting behavior and demand for policy intervention. In summary, an extensive informal economy can compromise the robustness of the model's variables and create a gap between official inflation measures and public inflation perceptions, thereby complicating policy design and effectiveness.

We acknowledge the contributions of researchers such as Friedman, McCandless and Weber, Blanchard and Fischer, Chenery and Syrquin, and Clarida, Galí, and Gertler, whose theoretical and empirical work laid the foundation for our study. Additionally, empirical studies from Ajayi and Khan, Kilindo, Amoah and Mumuni, Oyejide, Fielding, Olomola and Adejumo, Bawumia, Collier and Gunning, and Timmer provided valuable insights into inflation dynamics in Africa. Specifically, research on Angola by Ferreira, Alves and Silva, Martins, Sobrinho and Mano, Barros and Ramos significantly informed our contextual analysis. We also appreciate the constructive feedback from peers, which has refined our analytical approach and interpretation of results.

Policy recommendations

To stabilize prices and support sustainable growth, Angola's policymakers should strengthen monetary policy transmission to ensure effective interest rate adjustments, improve foreign exchange management to mitigate inflation from exchange rate fluctuations, and promote economic diversification and domestic production to reduce dependence on oil and imports. Furthermore, fiscal discipline should be enhanced through better debt management and deficit reduction, implement targeted interventions to stabilize food prices and support food security, and formalize the informal economy by improving data accuracy, incentivizing formalization, and tailoring policies to its unique dynamics, bridging gaps between official inflation measures and public perceptions for better policymaking.

Accomplishment of research objectives

The study used an ARDL model, diagnostic tests, and causality analysis to assess inflation determinants in Angola, international findings to refine policy recommendations for effective monetary management and long-term price stability.

Limitations of the research

Due to limited high-frequency data, the study did not assess the impact of inflation perception, potential GDP, and the informal sector on inflation, which may influence overall price dynamics in Angola.

References

- Ajayi, S.I., & Khan, M.S. (2000). *External debt and domestic capital formation in sub-Saharan Africa*. African Development Bank.
- Alves, J., & Silva, P. (2018). Money supply, exchange rates, and inflation in Angola: A VAR approach. *Journal of African Economies* 27(3), 350–372.
- Amoah, B., & Mumuni, Z. (2019). Fiscal expansion and inflation dynamics in West Africa. *African Journal of Economic Policy*, 26(1), 45–61.
- Balassa, B. (1964). The purchasing-power parity doctrine: A reappraisal. *Journal of Political Economy* 72(6), 584–596.
- Banco Nacional de Angola. (2022). *Monetary policy report*. Luanda, Angola: BNA.
- Barros, L., & Ramos, C. (2017). Inflation and food price volatility in Angola: A sectoral analysis. *African Development Review* 29(4), 512–529.
- Bastos, M., & Domingos, A. (2019). Logistical constraints and food price inflation in Angola. *Economic Bulletin of Southern Africa* 14(2), 65–82.
- Bawumia, M. (2010). Exchange rate movements and inflation in Ghana: Evidence from a structural VAR. *Bank of Ghana Working Paper*.
- Blanchard, O.J., & Fischer, S. (1989). *Lectures on macroeconomics*. MIT Press.
- Caetano Joao, M.A. & Castro, A.M. (2023). The Impact of Agricultural Credit on the Growth of the Agricultural Sector in Angola. *Sustainability* 15, 14704.
- Caetano Joao, M.A. (2024). Determinants of Sustainable Economic Growth in Angola: A Case Study on Agriculture. *Sci Set J of Economics Res* 3(6), 01-11.
- Chenery, H.B., & Syrquin, M. (1975). *Patterns of development, 1950–1970*. Oxford University Press.
- Clarida, R., Galí, J., & Gertler, M. (1999). The science of monetary policy: A New Keynesian perspective. *Journal of Economic Literature* 37(4), 1661–1707.
- Collier, P., & Gunning, J.W. (1999). Explaining African economic performance. *Journal of Economic Literature* 37(1), 64–111.
- Dornbusch, R. (1976). Expectations and exchange rate dynamics. *Journal of Political Economy* 84(6), 1161–1176.
- Ferreira, M. (2006). Inflation dynamics in Angola: The role of monetary policy and external factors. *African Journal of Economic Studies* 11(2), 89–106.
- Ferreira, M., & Neto, P. (2013). Oil price shocks and inflation volatility in Angola. *Energy Economics* 36 446–457.
- Fielding, D. (2008). Inflation and political instability in Africa. *Journal of Development Studies* 44(5), 731–757.
- Fisher, I. (1911). *The purchasing power of money*. Macmillan.
- Friedman, M. (1968). The role of monetary policy. *American Economic Review* 58(1), 1–17.
- Gordon, R.J. (1988). The role of wages in the inflation process. *American Economic Review* 78(2), 276–283.
- Hamilton, J.D. (1983). Oil and the macroeconomy since World War II. *Journal of Political Economy* 91(2), 228–248.
- International Monetary Fund (IMF). (2016). *Angola: Selected issues* (IMF Country Report No. 16/102). Washington, DC: IMF.
- Kilindo, A.A. (1997). Fiscal operations, money supply, and inflation in Tanzania. *AERC Research Paper No. 65*.
- Martins, J. (2015). The role of fiscal policy in inflation dynamics: Evidence from Angola. *African Economic Policy Review* 22(1), 112–129.
- McCandless, G.T., & Weber, W. E. (1995). Some monetary facts. *Federal Reserve Bank of Minneapolis Quarterly Review* 19(3), 2–11.
- Mkenda, B.K. (2001). Long-run and short-run determinants of real exchange rates in Africa. *Journal of African Economies* 10(1), 62–103.
- Ndulu, B., O’Connell, S. A., Bates, R. H., Collier, P., & Soludo, C. C. (2007). *The political economy of economic growth in Africa, 1960–2000*. Cambridge University Press.

- Nkoro, E., & Uko, A.K. (2016). Autoregressive distributed lag (ARDL) cointegration technique: Application and interpretation. *Journal of Statistical and Econometric Methods* **5**(4), 63–91.
- Olomola, P.A., & Adejumo, A. V. (2006). Oil price shock and macroeconomic activities in Nigeria. *International Research Journal of Finance and Economics* **3**(1), 28–34.
- Oyejide, T.A. (1972). Deficit financing, inflation, and capital formation: An analysis of the Nigerian experience, 1957–1970. *Nigerian Journal of Economic and Social Studies* **14**(2), 27–43.
- Phillips, A.W. (1958). The relation between unemployment and the rate of change of money wages in the United Kingdom, 1861–1957. *Economica* **25**(100), 283–299.
- Rogoff, K. (1996). The purchasing power parity puzzle. *Journal of Economic Literature* **34**(2), 647–668.
- Samuelson, P.A. (1964). Theoretical notes on trade problems. *Review of Economics and Statistics* **46**(2), 145–154.
- Sobrinho, R., & Mano, D. (2019). Inflation and government spending: Angola’s fiscal dilemma. *Economic Review of Southern Africa* **15**(2), 78–96.
- Taylor, J.B. (2000). Low inflation, pass-through, and the pricing power of firms. *European Economic Review* **44**(7), 1389–1408.
- Timmer, C.P. (2009). Rice price formation in the short run and the long run: The role of market structure in explaining volatility. *Center for Global Development Working Paper No. 172*.
- United Nations Conference on Trade and Development (UNCTAD). (2020). *Trade and development report 2020*. Geneva: UNCTAD.
- World Bank. (2021). *Angola economic update: Strengthening the macro-fiscal framework to promote economic diversification*. Washington, DC: World Bank.