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A Quantitative Analysis of the Balance of Payment Performance Using an Alternative Evaluation Approach: A Case of Zambia (1980 – 2020)

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Abstract

Purpose: This paper seeks to evaluate Zambia's balance of payment performance from 1980 to 2020 and thus provide a nuanced and in-depth assessment that offers a comprehensive understanding of its balance of payment dynamics beyond traditional methods.

Materials and Methods: The study employed the Vector Error Correction (VEC) model to integrate monetarist, elasticity, and Keynesian theories. Thus examine the short-run and long-run impact of Exchange Rate, Inflation Rate, Interest Rate, External Credit, Gross Domestic Product, and Foreign Direct Investment on Balance of Payment.

Findings: The empirical analysis reveals that exchange rate fluctuations, foreign direct investment (FDI), and external credit exert modest short-run effects on the BOP. However, in the long run, these factors demonstrate statistically significant impacts, highlighting their critical role in shaping Zambia's external account dynamics. The findings indicate that exchange rate depreciation enhances export competitiveness by making exports cheaper while increasing the cost of imports. FDI inflows contribute positively to the capital account, supporting the balance of payment. Conversely, higher reliance on external credit is associated with elevated debt servicing costs, adversely affecting the BOP. Furthermore, domestic inflation influences trade dynamics by making local goods relatively expensive, thereby reducing imports, while GDP growth spurs higher import demand due to increased domestic consumption. Higher interest rates, on the other hand, may suppress borrowing, thus reducing liquidity in the economy.

Implications to Theory, Practice and Policy: These results underscore the need for Zambia to adopt balanced macroeconomic policies that address structural vulnerabilities in the BOP. Key policy recommendations include inflation targeting to maintain price stability, exchange rate stabilization to foster trade competitiveness, diversification of FDI inflows to reduce dependency on a single sector, sustainable external credit management to mitigate debt burdens, and an export-oriented growth strategy to enhance foreign exchange earnings. By pursuing these measures, Zambia can strengthen its economic stability, sustain long-term growth, and reduce susceptibility to external shocks.

Keywords: *Balance of Payment, Exchange Rate, Inflation Rate, Interest Rate, External Credit, Gross Domestic Product, Foreign Direct Investment and Vector Error Correction Model (VECM)*

JEL Classification: C1, C5, E5

INTRODUCTION

Globalization and international trade have deepened economic, political, and cultural interdependence among nations. Countries assess their economic performance in global trade through the Balance of Payments (BOP), which measures external financial stability. A strong BOP provides a competitive advantage, while persistent deficits can weaken economic resilience. The current account balance is the key indicator used to evaluate these imbalances, as prolonged deficits can lead to financial crises, currency depreciation, and insolvency.

The relationship between a nation's economic development and its BOP is well established. A stable and moderate current account surplus supports economic growth, while large deficits hinder development. Scholars such as Fleermuys (2005) and Krugman et al. (2018) emphasize the importance of maintaining a stable BOP to prevent economic crises. One widely studied framework is the Monetary Approach to the Balance of Payments (MABP), which considers BOP disequilibrium a monetary issue caused by policy failures. According to Umer et al. (2010), under a fixed exchange rate system, BOP stability can be maintained through monetary adjustments rather than devaluation.

Pre-independence: Before independence and during the early 1960s, Zambia's economy was highly export-driven, largely benefiting from high copper prices. This enabled substantial foreign exchange earnings and high import volumes, making Zambia an open economy. However, increased dependence on trade and foreign investments exposed the country to external vulnerabilities. Over time, declining Foreign Direct Investment (FDI) inflows, credit expansion, fiscal deficits, and worsening terms of trade began to weaken the external balance (Salvatore, 2013).

Post-independence and Mulungushi Reforms: In the 1970s, Zambia initially pegged the Kwacha to the British Pound and later to the US Dollar, but subsequent devaluations led to a 20% depreciation. To stabilize the currency, Zambia linked the Kwacha to Special Drawing Rights (SDR**)**. However, the impact of these adjustments was mitigated by strict import restrictions and foreign exchange controls enforced by the Bank of Zambia. The government's allocation of foreign exchange distorted resource distribution and interest rate structures, reinforcing the country's dependence on imports. As a result, high levels of imports led to a disorderly real depreciation of the Kwacha. The absence of incentives to diversify export structures further exacerbated economic challenges (World Bank, 2004).

Structural Adjustment Programs: By the 1980s, Zambia turned to economic reforms and concessional credit from multilateral financial institutions to manage falling copper prices, rising external debt, and inefficient state-owned enterprises (SOEs). As part of the reforms Programs, Zambia removed import restrictions and liberalized trade, however, while this was intended to improve efficiency privatization of Zambia Consolidated Copper Mines (ZCCM) led to the repatriation of profits, and imports surged more than exports, thus capital outflows. Zambia was forced to use foreign reserves to service loans and borrowed heavily to finance reforms. In the 1990s, under President Frederick Chiluba, as part of Structural Adjustment Programs, exchange rate liberalization led to the depreciation of the Zambian kwacha. While a weaker currency made exports cheaper, Zambia's import-dependent economy suffered from higher import costs, worsening inflation and increasing the trade deficit**.** The cost of servicing external debt increased, further straining the BoP (World Bank, 2004).

Post Structural Adjustment Programs: In the early 2000s, even though the trade deficit worsened due to mining-related imports needed to reform the privatized copper industry. Nonetheless, an improvement in official and commercial inflows, supported by a resumption of concessional donor support, was expected to prompt a recovery. Zambia saw some BoP improvements due to debt relief under the Heavily Indebted Poor Countries (HIPC) Initiative, rising copper prices, and improved foreign direct investment (FDI) though repatriation of profits still affected capital flows (World Bank, 2018).

Pre-Covid pandemic, Zambia had recorded some temporary current account surplus due to increased commodity exports, particularly copper and gold. This was fueled by rising global copper prices, which consistently exceeded $6,000 per ton, alongside increased export volumes. In 2009, the country recorded a trade surplus of 397 million USD, which increased to 1,094 million USD in 2010, 715 million USD in 2011, and 918 million USD in 2012. More recently, Zambia achieved surpluses of 2,212 million USD in 2020. However, post-Covid, Zambia's capital account faced rising vulnerabilities. A significant increase in external debt financing, including a $750 million Eurobond, led to high debt-servicing costs. This, combined with currency depreciation, resulted in credit rating downgrades and declining foreign investment inflows. So much so Zambia defaulted on debt first in 2020. The Bank of Zambia relies on official reserves to buffer economic downturns, but these reserves consistently show negative balances.

This reflects chronic BOP deficits, limiting the country's ability to stabilize the exchange rate or respond to external shocks. As a result, there is no clear agreement on whether devaluation even improves the balance of payments of Zambia as would be suggested by conventional frameworks like elasticity approach. Thus, this study aims at evaluating the Zambia's balance of payments performance from 1980 to 2020 by integrating *monetarist, elasticity, and Keynesian theories,* in a bid to provide clarity and address inconsistencies found in previous research. The paper identifies significant anomalies in the composition of the balance of payments and understand their implications for Zambia's overall economic health, by testing the following hypotheses:

Hypothesis 1: Impact of External Debt on Balance of Payments

$\mathbf{H_0}$: There exists a no significant relationship between Zambia's external debt levels and its balance of payments performance.

Hypothesis 2: Commodity Price Volatility

$\mathbf{H_0}$: Fluctuation in the commodity prices does not results in a deficit trade balance.

Hypothesis 3: Effectiveness of Exchange Rate Policies

$\mathbf{H_0}$: The effectiveness of Zambia's exchange rate policies has no direct impact on its balance of payments.

Hypothesis 4: The role of the Foreign Direct Investment (FDI)

$\mathbf{H_0}$: Foreign direct investment inflows do not positively contribute to the balance of payments performance

Hypothesis 5: Government Fiscal Policy

$\mathbf{H_0}$: Fiscal policies implemented by the Zambian government have no direct impact on the current account balance.

Conducting a quantitative analysis of the balance of payments performance using an alternative evaluation approach serves as a crucial tool for achieving developmental goals, ensuring debt sustainability, fostering structural transformation, and addressing existing knowledge gaps. The literature indicates few studies on this topic; however, this paper aims to bridge the gap by providing a comprehensive and refined assessment of Zambia's balance of payments dynamics. Zambia's balance of payments (BoP) remains vulnerable due to its heavy reliance on mining, making it susceptible to external shocks. To improve BoP stability, the government can use fiscal policy, monetary policies and structural adjustments programs to promote investment in export-driven industries and modern infrastructure, reducing dependence on volatile commodity markets. However, limited fiscal capacity, monetary freedom and external economic risks pose challenges to sustaining a healthy BoP. Effective fiscal and monetary planning is crucial to managing trade balances, controlling debt levels, and ensuring long-term external stability. It is in this hope that this study will help policy makers to balance fiscal policy, monetary policy and structural adjustment programs. The paper is divided into five sections: (1) Introduction, (2) Literature Review, (3) Material and Methods, (4) Results and Discussion, and (5) Conclusion and Recommendations.

LITERATURE REVIEW

This chapter reviews empirical findings, covering theoretical and empirical approaches to the balance of payments.

Theoretical Review

Zambia's balance of payments is influenced by devaluation, a key adjustment process. Three main economic approaches; elasticity, absorption, and monetary, explain this phenomenon, each with distinct reasoning and ongoing academic debate.

The Elasticities Approach, Marshall-Leaner Condition, and J-Curve Theory

This theory explores how exchange rate changes offset price distortions using the Marshallian approach, focusing on foreign exchange demand and supply while excluding income and capital flows. It discusses elasticity, devaluation, and key economic approaches. The elasticity equation for the balance of payments can be expressed as follows:

$$\text{Elasticity} = \frac{\%\ \textbf{change in BOP}}{\%\ \textbf{change in the influencung variable}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad [2\text{-}1]$$

The balance of payments (BoP) responds to changes in exchange rates, GDP, and prices through different elasticities. Exchange rate elasticity measures BoP sensitivity to currency changes, while income and price elasticities track GDP and price effects. The Marshall-Lerner condition states that devaluation improves BoP if the sum of import and export elasticities exceeds one. If demand for imports is inelastic, devaluation may worsen the BoP. In developing nations, concerns over low elasticities raise doubts about devaluation's effectiveness. The "J-curve effect" suggests that devaluation may initially worsen the trade balance before leading to improvements over time (Miles. 1979).

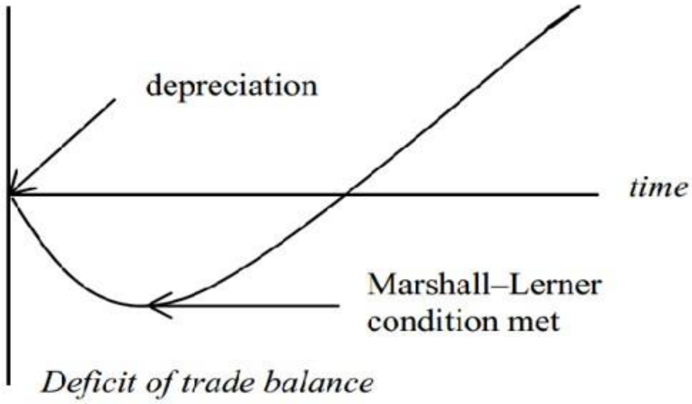

Figure 1: J-Curve-Phenomena

Source: Clarke Kulkarni, 2010

Keynesian Absorption Approach

The Elasticities approach links exchange rate effects to elasticities, while the Absorption approach analyzes income balance. Alexander presented the absorption approach, a different equilibrium analysis method, in 1952. The national income identity equation $Y = C + I + G + X - M$ *is* the first step in this method.

Where;

Y = income

C = private consumption of goods and services purchased at home and from abroad

I = total investment, by firms as well as by government

G = government expenditure on goods and services

X = exports of goods and services; and

M = imports of goods and services

Devaluation affects spending through real cash balance, money illusion, and income redistribution. Rising prices can reduce expenditure if consumption falls more than the real cash balance effect. However, devaluation alone is insufficient at full employment. Effective balance of payments management requires combining devaluation with deflationary policies and monetary controls (Alexander, 1952).

Monetary Approach

This method views balance of payments through a monetary perspective, treating disequilibria as stocks. Under fixed exchange rates, excess money increases spending, depleting reserves, while money shortages boost reserves, restoring equilibrium (Johnson, 1976).

$\boldsymbol{M_s = (R + D)}$ **[2-2]**

$\boldsymbol{M_d = L(Y, P, I)}$ **[2-3]**

$\boldsymbol{M_s = M + M_d}$ **[2-4]**

Real domestic income (Y) depends on money supply (Ms), international reserves (R), and domestic credit (D). Money demand (Md) influences equilibrium stock (M), which is affected by price level (P) and interest rate (I). The balance of payments is determined by the reserve flow equation shown below;

$$\{\partial \boldsymbol{R} = \partial[\boldsymbol{L}(\boldsymbol{Y}, \boldsymbol{P}, \boldsymbol{I})]\partial \boldsymbol{D}\} \quad \textbf{[2-5]}$$

The balance of payments adjusts through monetary effects, balancing domestic credit growth and money demand. A stable offset coefficient shows that rising domestic credit leads to a reverse change in international reserves.

Empirical Studies

The balance of payments (BOP) phenomenon has been extensively studied within international economics using various models, particularly the Monetary Approach to the Balance of Payment (MABP). Dhliwayo (1996) examined Zimbabwe (1980–1991) and found a strong negative correlation between domestic credit and international reserve outflows. Similarly, Mutale (1983) analyzed Zambia (1970–1980) using the Ordinary Least Square (OLS) method and observed that overseas reserves influenced domestic credit more than the money supply. Shamabobo (2015) reinforced these findings, revealing that Zambia's BOP was significantly affected by domestic credit, income, and the Consumer Price Index (CPI). Shamabobo further asserted that Kwacha depreciation led to CPI increases while boosting exports.

Adamu and Itsede (2010) used the Generalized Method of Moments (GMM) in the West African Monetary Zone, finding that domestic credit, interest rates, and exchange rates negatively impacted BOP, while GDP had a positive effect. However, the MABP model has been criticized for its sole reliance on monetary factors, neglecting real and fiscal aspects. Gulzer (2011) questioned its significance using Pakistan's data (1990–2008), and Bilquees (1989) found it inadequate in explaining BOP dynamics across 39 developing countries. Ali's error-correction model, however, showed a negative correlation between domestic credit and BOP, while income, exchange rates, and inflation had a positive impact.

Onyemauma and Odii (2003) found that foreign reserves, interest rates, and currency rates moved in sync with BOP equilibrium. Similarly, Faroung and Almahdi (2017) identified a long-term relationship between BOP and external credit, exchange rates, GDP, interest rates, and inflation. Egwaikhide (1997) used OLS regression to link money supply, price levels, domestic absorption, and current account balance, revealing a connection between budget and current account deficits. His findings emphasized the importance of budget discipline, highlighting that BOP disequilibrium extends beyond monetary concerns to fiscal and structural considerations.

Below is the summary of the empirical studies;

Title	Author(s)	Methodology	Findings	Gap Left
Balance of Payments Phenomenon in Zimbabwe (1980–1991)[1]	Dhliwayo (1996)	Monetary Approach to the Balance of Payment (MABP) model	Negative one-to-one association between domestic credit and international reserve outflows, showing the monetary aspect of BOP.	Focuses solely on monetary factors, neglecting real and fiscal considerations.
Study on Zambia's Balance of Payments (1970–1980)[2]		Ordinary Least Squares (OLS), linked to MABP	Overseas reserves had a greater influence on domestic credit than on money supply.	Limited to monetary factors, lacking consideration for structural or fiscal variables.
Monetary Approach to the Balance of Payment in Zambia[3]	Shamabobo (2015)	Empirical review of MABP	There is a significant impact of CPI, domestic credit, and income on BOP. Kwacha depreciation positively shocks CPI, making exports more attractive globally.	Ignores real and fiscal contributions to the BOP.
BOP and Monetary Variables in the West African Monetary Zone[4]	Adamu & Itsede (2010)	Generalized Method of Moment (GMM)	Domestic credit, interest rates, and exchange rates negatively affect BOP; GDP has a positive coefficient.	Overlooks structural, fiscal, and real economic interactions.
Critique of MABP's Significance Using Pakistan Data[5]	Gulzer (2011)	Econometric analysis	Found the MABP's significance questionable in explaining Pakistan's BOP dynamics (1990–2008).	Challenges the applicability of MABP but does not explore alternative models.
Cross-Sectional Analysis of 39 LDCs[6]	Bilquees (1989)	Aghevli and Khan (1977) cross-sectional model	MABP failed to effectively explain BOP dynamics across LDCs.	Lacked integration of country-specific factors or real-world constraints.

[1]Dhliwayo, R. (1996). Balance of Payments Phenomenon in Zimbabwe (1980–1991)**.** *African Journal of Economic Policy*, 3(1), 35–50.
[2]Mutale, L. (1983). Study on Zambia's Balance of Payments (1970–1980)**.** *Zambia Economic Review*, 5(3), 22–45.
[3]Shamabobo, K. (2015). Monetary Approach to the Balance of Payment in Zambia**.** *Zambian Journal of Economic Analysis*, 12(4), 85–100.
[4]Adamu, P. A., & Itsede, O. (2010). BOP and Monetary Variables in the West African Monetary Zone. *Journal of Monetary Studies*, 8(2), 125–140
[5]Gulzer, M. (2011). *Critique of MABP's Significance Using Pakistan Data*. Pakistan Journal of Social Sciences, 31(1), 123-137.
[6]Bilquees, F. (1989). *Cross-Sectional Analysis of 39 LDCs*. Journal of Developing Economies, 3(2), 45-60.

Error-Correction Modeling of Domestic Credit and BOP	Ali (Year unclear)	Error-correction modeling	Domestic credit negatively correlated with BOP, while incomes, exchange rates, and inflation showed positive correlations.	Limited focus on monetary and macroeconomic aspects.
Relationship Between BOP and Foreign Reserves, Interest Rates, and Currency Rates[7]	Onyemauma & Odii (2003)	Empirical research	Found synchronization between BOP and foreign reserves, interest rates, and currency rates; higher interest rates increased BOP equilibrium by boosting local currency demand.	Does not address broader fiscal and structural factors influencing BOP.
Long-Term Causal Relationship Between BOP and Macro Variables[8]	Faroung & Almahdi (2017)	Long-term causality tests	Proposed causal relationships between BOP and external credit, exchange rate, GDP, interest rates, and inflation.	Focuses on long-term trends without addressing short-term fluctuations or policy interventions.
Connections Among Money Supply, Price Level, Domestic Absorption, and Current Account Balance[9]	Egwaikhide (1997)	Ordinary Least Squares (OLS) regression	Significant correlation between current account deficit and budget deficit; stressed the importance of budget discipline to maintain equilibrium.	Neglects other structural factors that influence BOP beyond fiscal policy.

Conceptual Framework

Balance of payment may be more of a monetarist, structuralism' and fiscalism theory than a strictly monetary one. This offers a methodology for evaluating the varying effects of any disruptions resulting from macroeconomic variables like inflation, growth in the economy, and so on as seen below;

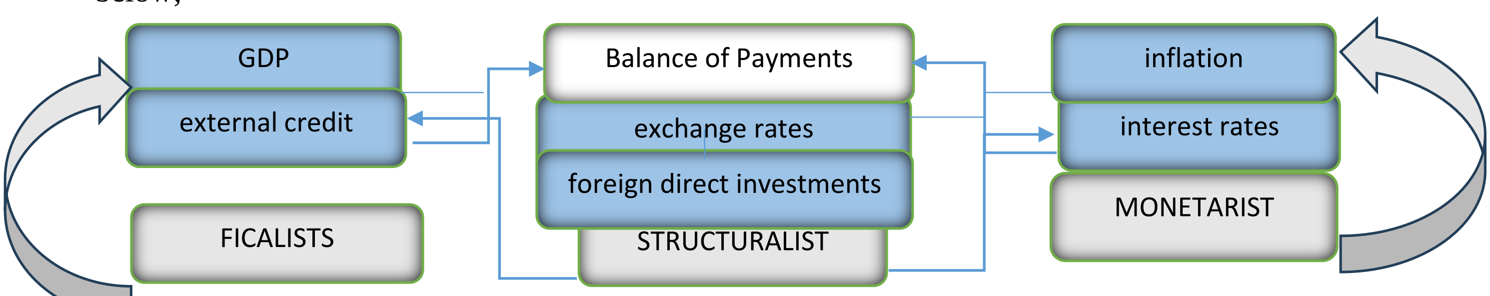

Figure 2: Conceptual Framework

[7]Onyemauma, P., & Odii, C. (2003). *Relationship Between BOP and Foreign Reserves, Interest Rates, and Currency Rates*. African Journal of Economic Policy, 10(3), 75-89
[8]Faroung, H., & Almahdi, A. (2017). *Long-Term Causal Relationship Between BOP and Macro Variables*. International Journal of Economics and Finance, 9(12), 198-210.
[9]Egwaikhide, F. O. (1997). *Connections Among Money Supply, Price Level, Domestic Absorption, and Current Account Balance*. African Economic Research Consortium (AERC), Research Paper 62.

Source: Author's Computation, 2025

MATERIALS AND METHODS

This section is divided into two main components. The first component focuses on the overall economic outlook and key macroeconomic indicators. The second component presents the empirical and econometric analysis.

Overview of Zambia's Balance of Payment Outlook and Macroeconomic Indicators

Zambia's Balance of Payments (BOP) has experienced fluctuations over the years, reflecting the country's external trade and capital flow dynamics. In 2001, the BOP recorded a surplus of 92.5 million USD, but it declined into negative territory in subsequent years, reaching -108.1 million USD in 2002 and -43.4 million USD in 2003. The BOP saw significant improvements in 2005 and 2006, recording surpluses of 2.07 billion USD and 1.69 billion USD, respectively. However, the trend has remained volatile, with substantial deficits recorded in years such as 2014 (-321.6 million USD), 2017 (-18.3 million USD), and 2019 (99.5 million USD). The largest surplus in the period was observed in 2020, reaching 425.4 million USD, likely due to external financial inflows during the COVID-19 pandemic.

Foreign Direct Investment (FDI) inflows have also exhibited fluctuations. FDI was 145 million USD in 2001, gradually increasing to 1.73 billion USD in 2010 and peaking at 2.1 billion USD in 2013. However, post-2013, FDI saw a declining trend, falling to 1.51 billion USD in 2014 and 663 million USD in 2016, before recovering to 1.58 billion USD in 2020. The trends in FDI inflows indicate Zambia's reliance on external investment, particularly in sectors such as mining, energy, and infrastructure, with global economic shocks influencing inflows significantly (UNCTAD, 2022). Zambia's GDP growth rate has been highly variable, peaking at 10.29% in 2010 but steadily declining to 2.92% in 2015, 3.77% in 2016, and 1.44% in 2019. The COVID-19 pandemic in 2020 led to a contraction of -2.78%, the lowest GDP growth rate in the period. The declining growth rates can be attributed to external shocks, structural economic weaknesses, and rising debt levels, which have constrained fiscal space and economic expansion (World Bank, 2024).

Inflation has been a persistent challenge for Zambia, fluctuating significantly over the years. In 2001, inflation stood at 25.33%, declining to 5.43% in 2014 due to stable monetary policies. However, inflation spiked again in 2016 (13.55%), 2020 (13.74%), and 2010 (13.95%), reflecting macroeconomic imbalances, currency depreciation, and external pressures on commodity prices. Managing inflation remains critical for maintaining economic stability and investor confidence (World Bank, 2024). The exchange rate (EX) has shown a steady depreciation over the years. In 2001, the exchange rate was approximately 3.61 units per USD, rising to 12.89 in 2019 and 18.34 in 2020, reflecting Zambia's exposure to external shocks and dependence on commodity exports, particularly copper. Exchange rate fluctuations have played a significant role in Zambia's inflationary trends and trade competitiveness (Mfula, 2024). Interest rates (INT) have also fluctuated, reaching 21.61% in 2002, falling to negative levels in 2020 (-3.75%), and exhibiting substantial volatility in the years in between. The variation in interest rates reflects changing monetary policy stances, external financial conditions, and domestic credit market dynamics (National Assembly of Zambia, 2023). The above information is summarized in table 1 below;

Table 1: Zambia's Key Macroeconomic Indicators (2001 – 2020)

Year	BOP (USD)	FDI (USD)	GDP (%)	Inflation Rate (%)	Exchange Rate (EX)	Interest Rate (INT)	EC (USD)
2001	92.5	1.45E+08	5.316868	25.33126	3.610935	16.67746	6.19E+09
2002	-108.105	2.98E+08	4.506014	19.39092	4.398595	21.61562	6.67E+09
2003	-43.403	3.47E+08	6.944974	17.60772	4.733271	19.52534	6.87E+09
2004	-6.8	3.64E+08	7.032395	19.71682	4.778875	9.196934	7.54E+09
2005	2074.635	3.57E+08	7.235599	16.6502	4.465	9.909085	5.37E+09
2006	1698.079	6.16E+08	7.903694	14.54225	3.601667	7.51782	2.26E+09
2007	-163.894	1.32E+09	8.352436	12.97021	4.001667	5.240871	2.75E+09
2008	158.304	9.39E+08	7.773896	10.64024	3.745	7.613795	3E+09
2009	-341.958	6.95E+08	9.220348	5.559686	5.045	15.63363	3.7E+09
2010	64.96359	1.73E+09	10.29822	13.95091	4.7975	6.112942	4.37E+09
2011	-109.465	1.11E+09	5.564602	11.11231	4.861667	6.951849	5.25E+09
2012	-170.718	1.73E+09	7.597593	6.992016	5.1475	4.821684	6.26E+09
2013	247.1664	2.1E+09	5.057232	9.73121	5.396483	-0.19172	6.99E+09
2014	-321.605	1.51E+09	4.697992	5.435782	6.154167	5.821128	9.97E+09
2015	432.313	1.58E+09	2.920375	6.659292	8.631667	6.179216	1.26E+10
2016	256.8	6.63E+08	3.776679	13.55248	10.3075	1.715079	1.61E+10
2017	-18.3	8.66E+08	3.504336	10.09573	9.5175	2.070262	2.41E+10
2018	387.8	7.64E+08	4.034494	7.411571	10.45833	2.215865	2.5E+10
2019	99.5	8.15E+08	1.441306	7.63347	12.89	2.469674	2.98E+10
2020	425.4	1.58E+09	-2.78506	13.7435	18.34409	-3.74908	3E+10

Source: World Bank (2024)

Zambia's external credit has risen significantly, reflecting its increasing reliance on debt financing, with external credit growing from $6.19 billion in 2001 to $30 billion by 2020. This rapid debt accumulation has raised concerns about debt sustainability, as rising debt servicing obligations have placed significant pressure on the national budget, reducing allocations to essential sectors like health, education, and infrastructure. In response to fiscal deficits, the government has implemented austerity measures, including subsidy reductions and tax increases, which have led to social and economic challenges. Additionally, Zambia's growing debt has negatively impacted its creditworthiness, resulting in credit rating downgrades by agencies like Moody's and S&P, making borrowing more expensive and limiting access to international financial markets. To address its unsustainable debt, Zambia has engaged in restructuring agreements, such as the $3 billion deal with private bondholders in 2024, aimed at extending repayment periods and reducing interest burdens. However, long-term debt sustainability depends on prudent macroeconomic policies, enhanced fiscal discipline, and structural reforms to improve economic resilience and diversification.

Empirical and Econometric Steps

In contrast to the Monetary Approach to the Balance of Payments (MABP) or the Keynesian Aggregate Demand Approach (Absorption), this study embraces a comprehensive framework that integrates all ideologies. It presents a model akin to Faroug and Almahdi's model (2017) of the Sudanese balance of payments. The study acknowledged limitations but identified the Vector Error Correction model (VECM) as the most suitable method for examining the long-term relationship among variables, outperforming alternatives like Engel Granger and Auto Regressive Distributed Lag (ARDL). Thus, the model's general formula is as follows:

$$\boldsymbol{BOP = f(EC, EX, GDP, INF, FDI, IR)} \qquad (1)$$

Where: $EC, EX, GDP, INF, FDI, IR$ are external credit, exchange rates, gross domestic product growth rate, inflation rate, foreign direct investment, and interest rate, respectively.

The model is represented in its stochastic form as:

$$\boldsymbol{LnBOP_t = \beta_0 + \beta_1 lnEC_t + \beta_2 lnEX_t + \beta_3 lnGDP_t + \beta_4 lnINF_t + \beta_5 lnFDI_t + \beta_6 lnIR_t + e_t \dots \dots \dots \dots \dots \dots\dots} \qquad (2)$$

Where β_0 represents the intercept term, $\beta_1, \beta_2,\ \beta_3,\ \beta_4\ and\ \beta_5\ \ \beta_6$ denote the partial regression coefficients for external credit, exchange rates, gross domestic product, inflation, foreign direct investment, and interest rate, respectively. t is the sample data period, and e_t is the stochastic term.

This paper used annual time series data from 1980 to 2020. The data was retrieved from the Bank of Zambia's Annual Reports and Statistical Bulletins, the World Bank's World Development Indicators (WDI), and the IMF's International Financial Statistics (IFS). However, data from reliable sources like Ministry of Finance (MOF) Reports, and Central Statistics Office (CSO) bulletin, was collected and used for counterchecking and consultation of data consistency during data analysis with STATA, EViews, R program and Excel.

Table 2: Variables Included, Their Descriptions and Sources 1990 - 2020

Variable	Symbol	Description	Sources
Balance of Payments	BOP	Billon USD	Bank of Zambia and World Bank
Inflation Rate	INF	Billon USD	Bank of Zambia and World Bank
Gross Domestic Product	GDP	Billon USD	Bank of Zambia and World Bank
Foreign Direct Investment	FDI	Billon USD	Bank of Zambia and World Bank
Exchange Rate	EX	Billon USD	Bank of Zambia and World Bank
External Credit	ED	Billon USD	Bank of Zambia and World Bank

Source: Bank of Zambia 2024 and World Bank 2024

Diagnostics Tests

Pre-Diagnostics Test

Unit Root Test

Unit root analysis in univariate time series seeks to determine the stationarity of a series. A process Y_t is stationary if it exhibits time-invariant mean and variance, and its covariance depends only on the time interval between observations, not on actual time. A unit root indicates non-stationarity, impacting econometric modeling by potentially leading to spurious regression results or indicating long-term relationships. Thus, unit root tests are crucial before estimation. this study employs the traditional Dickey-Fuller test to assess the stationarity of the time series data (Enders, 2004).

Co-integration Test

Testing for co-integration is essential to ascertain whether one is modeling empirically significant relationships. Variables with different trend processes cannot maintain a stable long-run relationship, making it challenging to model or draw inferences based on standard distributions (Lütkepohl, 2005). In the absence of co-integration, it becomes necessary to work with variables. Co-integration is a crucial criterion for attaining stationarity among non-stationary variables. According to Dickey and Fuller (1979), co-integration implies that if two or more time-series move closely together over the long term, despite being individually non-stationary, their differences remain constant, suggesting a stationary relationship. This indicates a long-run equilibrium relationship among the series, as their differences do not fluctuate over time. On the other hand, the absence of co-integration indicates that the variables do not share a long-run relationship and may drift apart significantly (Engle and Granger, 1987). Once variables are identified as integrated of order I (0), I (1), I (2), and so on, models can be developed to create stationary relations among them, permitting standard inference

Johansen Test

The Johansen (1995) method tests the restrictions imposed by co-integration on the Vector Error Correction (VEC) model involving time series data. The general Johansen framework, which also accommodates the possibility of deterministic trends, can be specified as follows:

$$\boldsymbol{Y_t = A_1Y_{t-1} + A_2Y_{t-2} + \cdots + A_pY_{t-p} + BD_t + \epsilon_t} \quad (3)$$

Where:

- Y_t is an $n\ x$ 1 vector of non-stationary I(1) variables.
- $\boldsymbol{A_i}$ (for $\mathrm{i} = 1, 2, \ldots, \mathrm{p}$) are nxn coefficient matrices.
- $\boldsymbol{D_i}$ is a vector of deterministic components (e.g., intercept, trend)?
- **B** is a matrix of coefficients for the deterministic components.
- ϵ_t is a vector of white noise error term?

The VEC model representation can be written as:

$$\boldsymbol{\Delta Y_t = \prod Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + BD_t + \epsilon_t} \quad (4)$$

- $\boldsymbol{\Delta Y_t}$represents the first differences of $\boldsymbol{Y_t}$
- $\prod = \sum_{i=1}^{p} \boldsymbol{A_i - I}$ (where $\boldsymbol{I}$ is the identity matrix) is the matrix that captures the long-run relationships among the variables.

- $\boldsymbol{\Gamma_i = \sum_{j=i+1}^{p} A_j}$ (for $\boldsymbol{i = 1, 2, .., p-1}$) are the short-run adjustment coefficients.

The rank of ∏ the matrix determines the number of co-integrating relationships:

- If the rank ∏ is zero, there are no cointegrating relationships, and the variables are not co-integrated.
- If the rank ∏ is r (where $0 < r < n$), there are r co-integrating relationships.

The Johansen method involves estimating the ∏ matrix and testing its rank using trace and maximum eigenvalue tests to determine the number of co-integrating vectors. This approach provides a systematic way to identify long-run equilibrium relationships among the time series variables while accounting for both stochastic and deterministic trends. The Johansen method tests for co-integration by comparing models with and without co-integrating equations. Significant differences between these models indicate co-integration. Johansen developed two tests for this: the maximum eigenvalue test (λ-max) and the trace test as shown below;

$$\boldsymbol{\lambda_{max} = -Tlin(1 - \lambda_i)} \quad (5)$$

$$\boldsymbol{\lambda_{trace} = -T\sum_{i=r+1}^{p}(1 - \lambda_i)} \quad (6)$$

The Johansen method uses two tests to determine co-integration: the maximum eigenvalue test compares models with r vs. r+1 co-integrating relations, while the trace test compares models with ≤ r vs. > r relations. Sjö (2008) suggests the trace test is superior due to its robustness against skewness and kurtosis issues.

Post Diagnostics Tests

Model Specification Tests

Model specification tests evaluate whether an econometric model appropriately captures the underlying data generation process. Key tests include the Ramsey RESET test for omitted variable bias (Ramsey, 1969), the Hausman test for model consistency in fixed versus random effects (Hausman, 1978), and the Breusch-Pagan test for heteroscedasticity (Breusch & Pagan, 1979). The correct specification ensures valid inference and reliable predictions, while mis-specification can lead to biased estimates and incorrect conclusions, undermining the model's credibility and usefulness in policy and decision-making (White, 1980). To address issues of omitted variables, irrelevant factors, and incorrect data forms that may lead to biased coefficients and inaccurate predictions, a penalty term for model parameters is introduced. The Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC) serve as tools to assess model complexity, with a lower BIC value indicating a superior model.

Ramsey Reset Test

The Ramsey RESET (Regression Equation Specification Error Test) is a diagnostic tool used to detect misspecification in a regression model. It tests for omitted variables, incorrect functional forms, and other specification errors by adding powers of the fitted values to the regression. If these additional terms are statistically significant, it suggests model misspecification. This test is crucial for ensuring model accuracy, as mis-specified models can lead to biased and inconsistent estimates. This paper will use The RESET test to refine the model for better predictive power and reliability (Ramsey, 1969). The Ramsey RESET test will be employed to ensure correct model specification by testing the joint significance of coefficients. These measures are indispensable for validating model assumptions and improving robustness.

To apply the RESET test in Zambia's BoP analysis, a VECM model was estimated with Balance of Payment as the dependent variable and exchange rate, inflation, interest rate, external credit, GDP, and FDI as independent variables. The optimal lag length is chosen using AIC or BIC, and Johansen's cointegration test confirms long-run relationships. The RESET test was used to check for misspecification by adding squared and cubic fitted BoP values; significance suggests potential model issues.

Stability Test

Stability tests are critical in econometric analysis to ensure that the parameters of a model remain constant over time, thereby validating the model's reliability for forecasting and policy analysis. These tests help identify structural changes or instability that could render a model ineffective. In the context of Vector Error Correction Models (VECM), stability can be examined by analyzing the eigenvalues of the companion matrix. If all eigenvalues lie inside the unit circle, the system is considered stable. This method ensures that the long-run relationships specified by the VECM are valid over the sample period, providing confidence in the model's predictive power and robustness for policy analysis. This study used the examination of eigenvalues of the companion matrix to check for the stability of the estimated VECM.

Normality Test

In assessing normality, a large sample size mitigates concerns, but non-normal data can distort mean representation and significance. A normality test assesses whether a dataset follows a normal distribution. Various methods exist for this purpose. The Shapiro-Wilk test is widely used due to its high power for small sample sizes (Shapiro & Wilk, 1965). The Kolmogorov-Smirnov test compares the sample distribution to a reference normal distribution (Kolmogorov, 1933; Smirnov, 1948). The Anderson-Darling test modifies the K-S test to give more weight to the tails (Anderson & Darling, 1954). The Doornik-Hansen ensures parametric tests' validity, correct hypothesis testing, and confidence interval accuracy. The Jarque-Bera test evaluates skewness and kurtosis (Jarque & Bera, 1980). It's widely used in econometrics and finance to check the normality of residuals in regression models, as normality is a key assumption in many statistical methods.

Test for Heteroscedasticity

Heteroscedasticity[10] is a condition in regression analysis where the variance of the residuals (errors) is not constant across all levels of the independent variables. This violates one of the key assumptions of the Classical Linear Regression Model (CLRM), which assumes homoscedasticity, meaning that the variance of the errors should be constant (Gujarati & Porter, 2009). The problem of heteroscedasticity was first discussed in the econometric literature by Goldfeld and Quandt (1965), who introduced a formal test for detecting this issue. Since then, numerous methods have been developed to test for heteroscedasticity, each with its advantages and limitations.

Common Tests for Heteroscedasticity include the Breusch-Pagan test is a widely used method for detecting heteroscedasticity. It tests the null hypothesis that the variance of the errors is constant. The test involves regressing the squared residuals on the independent variables and examining

[10]Definition of Heteroscedasticity, "An Introduction to Statistical Methods and Data Analysis" by Richard L. Ott and Michael Longnecke.

whether these variables significantly explain the variance in the errors (Breusch & Pagan, 1979). White's test is a more general test for heteroscedasticity that does not assume a specific form of heteroscedasticity. It tests for any kind of heteroscedasticity by including cross-product and quadratic terms of the independent variables in the auxiliary regression (White, 1980). The ARCH test is used primarily in time series analysis to detect autoregressive conditional heteroscedasticity, where the variance of the errors depends on previous periods' errors. This type of heteroscedasticity is common in financial time series data (Engle, 1982). The Goldfeld-Quandt test is another method that involves splitting the data into two subsets and comparing the variances of the residuals in each subset. It is particularly useful when heteroscedasticity is suspected to be related to one of the independent variables (Goldfeld & Quandt, 1965).

Testing for heteroscedasticity is appropriate and important when working with Vector Error Correction Models (VECM). In the context of VECM, heteroscedasticity can affect the efficiency of the estimators and the validity of statistical inferences, such as hypothesis tests and confidence intervals. Heteroscedasticity can lead to incorrect standard errors, which in turn affects t-tests, F-tests, and confidence intervals, making them unreliable. Thus, testing for heteroscedasticity in this study will help diagnose the model and determine whether further adjustments (e.g., robust standard errors or transforming variables) are necessary.

FINDINGS

Descriptive Statistics

The initial step in analyzing data properties involves presenting their fundamental statistics. The table below provides a comprehensive summary of the descriptive statistics, including the mean, median, maximum, minimum, and standard deviation for the variables under consideration in this study.

Table 3: Descriptive Statistics of the Data

Variable Name	Symbol	Mean	Stnd. Dev.	Minimum	Maximum
Balance of Payment	BOP	221.5143	521.6753	-341.958	2074.635
Exchange Rates	EX	3.587106	4.139587	.0007887	18.34409
Foreign Direct Investment	FDI	5.28e+08	5.96e+08	1.72e+07	2.10e+09
Inflation Rate	INF	32.87903	38.25167	5.435782	165.534
Interest Rate	IR	-.1587465	16.12977	-41.79025	23.67049
External Credit	EC	8.19e+09	6.86e+09	2.26e+09	3.00e+10
GDP Growth Rate	GDP	3.457783	3.943363	-8.625442	10.29822

Source: Author's Computation (2024), ***Note:*** *The usable observations in our analysis total 40, representing the sample size.*

Structural Stability Test

Table 4: F – GLS Test for Residues

Test statistic	1% Critical Value	5% Critical Value	10% Critical Value
-4.170	-3.770	-3.183	-2.865

Source: Author's Computation (2024)

Since the test statistics are more negative than the critical values at the chosen significance levels, we reject the null hypothesis of a unit root. This means, the residuals from this co-integration model are stationary and the co-integration relationship among the variables is stable, thus we have a robust model indicating a meaningful long-term equilibrium relationship.

Unit Root Analysis

This section presents the results of the unit-roots test. The traditional Dickey-Fuller test is used to test for unit roots in this study.

Dickey-Fuller Unit Root Test

Results of the traditional Dickey-Fuller test

Variable	**Level, Z(T)[P-Value], Integration I (1)**	**First Difference, Z(T)[P-Value], Integration I (0)**
Balance of Payment	-2.950 [0.0398]	-7.379 [0.000] *
Exchange Rate	-2.242 [0.1912]	-2.822 [0.055] ***
Foreign Direct Investment	-1.063 [0.7297]	-6.961 [0.000] *
Inflation Rate	-1.815 [0.3731]	-5.308 [0.000] *
Interest Rate	-1.757 [0.4020]	-6.033 [0.000] *
External Credit	-0.661 [0.8566]	-3.375 [0.012] **
GDP Growth rate	-2.208 [0.2034]	-7.041 [0.000] *

Source: Author's Computation (2024), ***Note:*** *The asterisk ***, **, * indicate the significance of the results at 10%, 5%, and 1% respectively.*

Table 5 reports the test statistics for both the level and first difference of Exchange Rate, Foreign Direct Investment, Inflation Rate, Interest Rate, External Credit, and GDP Growth Rate. At all conventional levels of significance, we reject the null hypothesis of unit root for both variables. In this case, all variables can be classified as being integrated of order one, that is I (1).

Model Specification Test

Results of the Ramsey Reset Test

F (3,32)	Prob > F
1.27	0.3019

Source: Author's Computation (2024)

Since the p-value (0.3019) is greater than the typical significance level of 0.05, we fail to reject the null hypothesis. This indicates that there is no statistical evidence of model misspecification in terms of omitted variables or incorrect functional form based on the Ramsey Reset Test.

Co-integration Test

Lag Selection Criteria

The lags to enter the system were determined using LR, FPE, AIC, and HQIC which all chose lag four (4). The results for several criteria to choose the optimal lag length are presented below:

Table 1: Lag Selection Criteria

lag	LL	LR	p	FPE	AIC	HQIC
0	-349.556	.553356		19.2733	19.3807	19.5781
1	-142.132	414.85	0.000	.000111	10.7098	11.5694
2	-81.4647	121.33	0.000	.000079	10.0792	11.6909
3	14.0446	191.02	0.000	.000016	7.56515	9.92895
4	112.945	197.8*	0.000	.000014*	4.86786*	7.98376

Source: Author's Computation (2024), ***Note:*** **indicates the significance of the results at a 5% significance level.*

Using the commonly used lag selection criteria like the Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Final Prediction Error FPE, it is suggested that including four lags provides a good balance between model complexity and fit for this specific dataset. Therefore, Table 3.5 indicates that the optimal lag length is four.

Johansen Test

Since the unit root tests reported that all the series were integrated of order one, Therefore, the study proceeded to test for co-integration among the variables to check whether they have a stable long-run equilibrium relationship. The Johansen test is used to determine the number of co-integrating relationships in a multivariate time series dataset. The Johansen test of integration using the trace statistic was conducted as shown below;

Johansen Test for Co-integration: Lags = 4

Rank	Parms	LL	Eigenvalue	Trace Statistic	5% Cri.Value
0	154	-39.67127	305.2319	124.24	
1	167	17.760464	0.95515	190.3684	94.15
2	178	50.138223	0.82625	125.6129	68.52
3	187	76.5361	0.75995	72.8171	47.21
4	194	95.127057	0.63392	35.6352	29.68
5	199	105.49636	0.42908	14.8966**	15.41
6	202	112.90724	0.33007	0.0749	3.76
7	203	112.94468	0.00202		

Source: Author's Computation (2024)

Based on the above Table 3.6 Johansen test results, there are five co-integrating relationships among the variables at the 5% significance level. The trace statistic (14.8966) is slightly less than the critical value (15.41). Therefore, we fail to reject the null hypothesis that there are at most 5 co-integrating equations. This means there are long-run equilibrium relationships between the variables in the dataset

Vector Error Correction (VEC) Analysis

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Table 7: Vector Error Correction Short Run Dynamics

	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
L	-.217	.089	-2.44	.015	-.391	-.043	**
LD	-.197	.262	-0.75	.453	-.711	.318	
L2D	-.292	.287	-1.02	.309	-.855	.271	
L3D	.08	.228	0.35	.724	-.366	.526	
LD	15.568	5.024	3.10	.002	5.722	25.415	***
L2D	7.507	6.178	1.22	.224	-4.603	19.616	
L3D	5.701	3.827	1.49	.136	-1.8	13.202	
LD	-.401	1.262	-0.32	.751	-2.874	2.073	
L2D	-.373	1.213	-0.31	.758	-2.75	2.004	
L3D	2.738	1.214	2.25	.024	.358	5.119	**
LD	.893	1.874	0.48	.634	-2.78	4.566	
L2D	.926	1.591	0.58	.561	-2.192	4.043	
L3D	-1.527	1.607	-0.95	.342	-4.678	1.623	
LD	-3.622	5.074	-0.71	.475	-13.568	6.323	
L2D	-10.959	4.885	-2.24	.025	-20.533	-1.384	**
L3D	.779	4.129	0.19	.85	-7.314	8.871	
LD	-6.638	4.179	-1.59	.112	-14.829	1.552	
L2D	-2.178	2.14	-1.02	.309	-6.372	2.017	
L3D	-1.588	1.308	-1.21	.225	-4.15	.975	
LD	-.752	1.15	-0.65	.513	-3.005	1.501	
L2D	-1.051	1.062	-0.99	.322	-3.132	1.03	
L3D	-1.523	1.071	-1.42	.155	-3.623	.577	
Constant	-.037	.885	-0.04	.967	-1.77	1.697	
Mean dependent var	1.194	SD dependent var	0.827				
Number of obs	37.000	Akaike crit. (AIC)	.				
**** p<.01, ** p<.05, * p<.1*							

Source: Authors' computations (2024)

Short-Run Dynamics (LD, L2D, L3D)

$$\Delta(Log_{bop})$$

$$\Delta(Log_{bop}) = -0.037 - 0.217ECT_{t-1} + (-1.523\Delta Log_{int,t-3} - 1.051\Delta Log_{int,t-2} - 0.752\Delta Log_{int,t-1}) + (0.779\Delta Log_{ec,t-3} - 10.959\Delta Log_{ec,t-2} - 3.622\Delta Log_{ec,t-1}) + (-1.527\Delta Log_{inf,t-3} + 0.926\Delta Log_{inf,t-2} + 0.893\Delta Log_{inf,t-1}) + (2.738\Delta Log_{fdi,t-3} - 0.373\Delta Log_{fdi,t-2} - 0.401\Delta Log_{fdi,t-1}) + (5.701\Delta Log_{ex,t-3} + 7.507\Delta Log_{ex,t-2} + 15.568\Delta Log_{ex,t-1}) + (0.080\Delta Log_{bop,t-3} - 0.292\Delta Log_{int,t-2} - 0.197\Delta Log_{bop,t-1}) \ldots\ldots (8)$$

As indicated in Table 3.7 above, the Error Correction Term (ECT) coefficient is -0.217, significant at the 5% level (p = 0.015). This implies that approximately 21.7% of any deviation from the long-run equilibrium is corrected in each period, ensuring a gradual adjustment back to stability. The negative sign of the ECT confirms the presence of convergence, meaning that the system is dynamically stable and will revert to its equilibrium path following a short-term shock, agreed with (Engle & Granger, 1987; Johansen, 1991). A one-unit increase in the recent exchange rate led to a significant increase of 15.568 units in the dependent variable in the short run, agreed with (Sundararajan & Balasubramanian, 2021; Hassan et al., 2022). This highlights the strong and positive short-term impact of exchange rate fluctuations on economic dynamics. Pertaining to foreign direct investment, a one-unit increase in the third lag of FDI resulted in a 2.738-unit increase in the dependent variable, significant at the 5% level, agreed with (Borensztein et al., 1998; Ayanwale, 2007). This suggests that past FDI inflows continue to influence the economy, though with a relatively smaller magnitude compared to exchange rate movements. Concerning the short-run effects of external credit, a one-unit increase in this variable reduced the dependent variable by 10.959 units, significant at the 5% level, agreed with (Reinhart & Rogoff, 2010; Saungwem et al., 2023). The negative coefficient indicates that an accumulation of external credit exerts an adverse impact, potentially due to debt burden effects, crowding out private investment, or increased macroeconomic vulnerabilities. These findings reinforce the critical role of exchange rate dynamics, FDI persistence, and external credit conditions in shaping short-term economic fluctuations, suggesting that policymakers should adopt targeted strategies to manage exchange rate volatility and external debt accumulation while promoting stable FDI inflows.

Table 8: Vector Error Correction Long Run Dynamics

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	6	261.353	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
_ce1						
log_bop	1	.	.	.	.	.
log_ex	9.427877	1.18445	7.96	0.000	7.106398	11.74936
log_fdi	5.975917	1.689377	3.54	0.000	2.664799	9.287035
log_inf	22.06049	1.676574	13.16	0.000	18.77446	25.34651
log_ec	-36.92699	3.388058	-10.90	0.000	-43.56747	-30.28652
log_gdp	-56.27747	4.815932	-11.69	0.000	-65.71652	-46.83841
log_int	-3.779234	1.402877	-2.69	0.007	-6.528822	-1.029647
_cons	753.1974	.	.	.	.	.

Source: Authors' computations (2024)

Long-Run Dynamics

The Johansen cointegration test confirms the existence of a long-run relationship among the variables, as evidenced by the significant chi-square statistic ($\chi^2 = 261.353$, p-value = 0.0000). The normalization restriction is imposed on the balance of payments, which serves as the dependent variable. Below is the estimated model;

$$ECT_{t-1} = 1.000 lnBOP_{t-1} - 36.92699 lnEC_t + 9.427877 EX_t - 56.27747 GDP_t + 22.06049 INF_t + 5.975917 lnFDI_t - 3.779234 IR_t + 753.1974 \ldots\ldots\ldots\ldots (9)$$

A 1% increase in the exchange rate leads to an increase in the balance of payments by approximately 9.4279 USD. This suggests that currency depreciation improves the external balance, potentially making exports more competitive. A 1% rise in FDI inflows increases the balance of payments by 5.9759 USD, indicating that FDI contributes positively to external account stability. This aligns with findings by Sharaf and Shahen (2023). A 1% increase in inflation raises the balance of payments by 22.0649 USD. This suggests that inflationary pressures may boost nominal exports, leading to improvements in the current account balance, consistent with prior literature. A 1% rise in external debt reduces the balance of payments by 36.9629 USD, implying that higher debt burdens negatively impact external stability, consistent with Andersson et al. (2000) and Saungwem et al. (2023). A 1% increase in GDP reduces the balance of payments by 56.2774 USD, suggesting that higher domestic output might be associated with increased imports, worsening the current account deficit. This finding is aligned with Dogan (2014) but contrasts with Sengupta and Puri (2020) and Wang et al. (2022). A 1% rise in lending rates leads to a 3.7792 USD reduction in the balance of payments, indicating that higher interest rates might discourage investment and economic activity, leading to worsening external balances, in agreement with Calimanu (2023).

Stability Test for the Vector Error Correction Model

Table 9: Results of Companion Matrix for Stability Condition

Eigenvalue		Modulus
1		1
1		1
1		1
1		1
1		1
1		1
-.1392093 +	.8937775i	.904554
-.1392093 -	.8937775i	.904554
-.6624902 +	.5516804i	.862116
-.6624902 -	.5516804i	.862116
-.481778 +	.7124528i	.860058
-.481778 -	.7124528i	.860058
.8401384		.840138
-.8268952		.826895
.2206165 +	.7671988i	.798289
.2206165 -	.7671988i	.798289
.6128867 +	.2965924i	.68088
.6128867 -	.2965924i	.68088
.2904973 +	.557014i	.628214
.2904973 -	.557014i	.628214
.102623 +	.6038798i	.612538
.102623 -	.6038798i	.612538
-.5924618		.592462
-.1694784 +	.5445787i	.570341
-.1694784 -	.5445787i	.570341
.3804354		.380435
.3006265		.300626
-.2746448		.274645

Source: Authors' computations (2024)

Table 9 presents that the vecm specification imposes 6-unit moduli

For the model to be valid, one key property is that the model must be stable. A VEC is stable if the modulus of each eigenvalue of a companion matrix is strictly less than one. This observation will signify that the system is stable, implying that the impulse responses will gradually decay over time rather than diverge uncontrollably. Then the model will demonstrate well-behaved dynamics, with the effects of shocks diminishing rather than amplifying indefinitely. This stability confirms that the system does not exhibit explosive behavior in the short term and that the error correction mechanism is operating effectively to restore equilibrium.

Table 10: Diagnostic Tests Vector Error Correction Dynamics

Problem	**Test**	**p-value**
Autocorrelation	Lagrange-Multiplier (LM) test	0.123
Heteroskedasticity	ARCH-LM test	0.1554
Normality	Jarque-Bera	0.07761

Source: Authors' computations (2024)

Table 10 reports the calculated p-value for the LM Test is greater than the 5% level of significance. This means that the residuals of our VEC model are not auto-correlated. This result also amplifies the correct specification of our VEC model. The Jarque-Bera test suggests that the model's residuals are generally close to normal distribution at a 5% level of significance. Finally, the p-value 0.1554**,** is greater than the common significance level of 0.05. Therefore, fails to reject the null hypothesis. This result suggests no significant ARCH effects in the residuals of this Vector Error Correction model. The residuals appear to be homoscedastic, indicating that there is no evidence of volatility clustering or time-varying variance in the model's disturbances. This result supports the adequacy of the VECM model in terms of heteroscedasticity, as the absence of ARCH effects implies that the variance of residuals is stable over time.

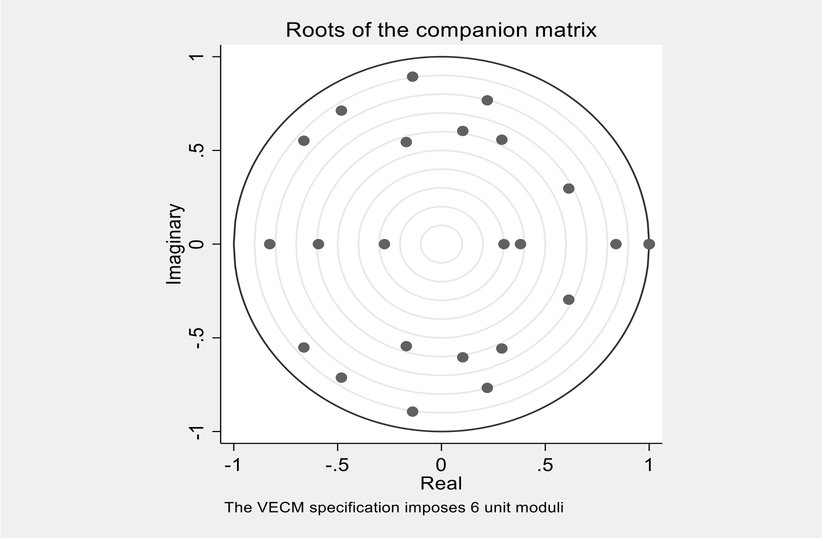

Figure 4: Results of Companion Matrix for Stability Condition

Source: Authors' computations (2024)

Figure 4 presents that the VECM specification imposes a 6-unit moduli[2].

1. **Unit Moduli (1)**: There are 6 eigenvalues with moduli equal to 1, which is expected for the number of co-integrating vectors specified in the model.
2. **Other Moduli (<1)**: All other eigenvalues have moduli less than 1, with the highest being approximately 0.904554.

Since all eigenvalues, other than the unit moduli, have moduli less than 1, the VECM satisfies the stability condition. Thus, VECM is stable based on the eigenvalue stability condition, as all eigenvalues (except the expected unit roots) have moduli less than 1.

CONCLUSION AND RECOMMENDATIONS

Economic sustainability hinges on the establishment of a well-structured debt management framework and sound policy systems. This paper employs the Vector Error Correction Model (VECM) to analyze the intricate dynamics between sovereign debt, tax policies, lending rates, and foreign direct investment (FDI) inflows in Zambia from 1990 to 2020. The findings reveal that Zambia's sovereign external debt surged to approximately USD 30 billion in 2020, with a debt-to-GDP ratio peaking at 118%. This alarming trend has exerted considerable downward pressure on FDI inflows. Notably, for every USD 1 billion increase in debt stock, FDI inflows experienced a substantial reduction, both in the short and long term. For instance, FDI inflows declined from USD 1.73 billion in 2013 to USD 1.58 billion in 2020, reflecting the adverse impact of debt accumulation. Such data underscores the urgent need for strategic policy interventions to address economic vulnerabilities and foster an environment conducive to sustainable investment.

Zambia's balance of payments (BoP) is profoundly influenced by key macroeconomic variables, including external debt, commodity price volatility, exchange rate fluctuations, FDI, fiscal policies, GDP growth rates, interest rates, and inflation. High external debt levels have significantly strained the BoP due to rising debt servicing costs, which far outweigh the short-term benefits of credit inflows. For example, Zambia's BoP recorded deficits in multiple years, such as -USD 341.96 million in 2009 and -USD 321.6 million in 2014, reflecting fiscal pressures. The Zambian kwacha experienced substantial depreciation, from ZMW 4.46 per USD in 2005 to ZMW 18.34 per USD in 2020, deterring foreign investment due to volatility. Inflation rates surged from 7.41% in 2018 to 13.74% in 2020, eroding purchasing power and investor confidence. Interest rates remained high, with fluctuations from 16.67% in 2001 to a negative rate of -3.75% in 2020, reflecting volatile monetary conditions that limit domestic borrowing and investment. Although FDI contributes positively to the BoP, its concentration in the extractive sector has led to profit repatriation, limiting long-term developmental impacts. Fiscal policies, particularly expansionary ones, have also shown a direct correlation with widening current account deficits, which reached USD -109.47 million in 2011. Additionally, Zambia's GDP growth rate, which plummeted from 9.22% in 2009 to -2.78% in 2020, reflects the economy's susceptibility to external shocks and internal structural inefficiencies.

Zambia should implement a multifaceted strategy: First, adopting prudent debt management practices is crucial to reduce external borrowing risks. This includes enhancing debt transparency, prioritizing concessional financing over high-interest commercial loans, and aligning debt acquisition with capital projects that yield economic returns. Second, diversifying the export base beyond copper to sectors like agriculture, manufacturing, and technology will reduce vulnerability to commodity price shocks. The following specific initiatives can be considered in each of the sectors listed above:

Agriculture: The government can provide government subsidies for inputs like fertilizers and seeds, offer low-interest loans to smallholder farmers, and invest in rural infrastructure such as irrigation systems and storage facilities. This sector requires a lot of funding for irrigation initiatives. Given the climate change shocks that the sector is faced with, the government should encourage financial sector involvement through the provision of affordable and accessible financing initiatives. Further, group smallholder farmer irrigation infrastructure should be encouraged especially in rural areas. To go around the high cost of setting up irrigation systems, aggregating smallholders in accessing irrigation services and agricultural extended services can be considered.

Manufacturing: To boost Zambia's manufacturing sector and diversify its export base, the government should implement targeted policy measures to attract investment, enhance productivity, and increase value addition to raw materials. Key strategies include tax incentives for local production, such as reducing corporate tax rates for export-oriented manufacturers, offering tax holidays or duty exemptions for investments in machinery and infrastructure, and providing VAT rebates on locally sourced raw materials to strengthen domestic supply chains.

Additionally, industrial parks and Special Economic Zones (SEZs**)** should be developed with subsidized utilities, improved transport infrastructure, and streamlined regulatory processes to lower production costs and enhance market access. Strengthening public-private partnerships (PPPs) for skills development is crucial this can be achieved by collaborating with private sector players and technical institutions to develop vocational training programs, promoting foreign direct investment (FDI) with technology transfer agreements, and incentivizing companies to invest in research and development (R&D) for industrial innovation.

Technology: Establishing innovation hubs and tech incubators in key urban centers will support startups by providing co-working spaces, mentorship, funding, and research facilities. Public-private partnerships can help fund and manage these hubs to ensure sustainability. Additionally, offering tax incentives such as reduced corporate tax rates and grants for tech startups particularly in fintech, agritech, and e-commerce can encourage entrepreneurship. Export incentives for tech firms providing international services will also enhance Zambia's balance of payments.

Expanding and modernizing digital infrastructure is crucial for the country's digital transformation. The government should invest in nationwide fiber-optic networks, improve mobile network coverage in rural areas, and collaborate with international firms to attract foreign direct investment (FDI) in digital projects. Workforce development is equally important; integrating technology-focused education into schools and universities and establishing vocational training centers will equip young professionals with essential digital skills. Incentives for companies investing in employee upskilling and technology transfer will further strengthen the sector. Lastly, enhancing intellectual property protection and implementing strong data security regulations will build investor confidence and encourage innovation, positioning Zambia as a competitive player in the global digital economy.

Finally, fostering robust GDP growth through export-oriented strategy growth will enhance economic resilience. Fiscal consolidation efforts will ensure macroeconomic stability, foster investor confidence, and support Zambia's Vision 2030 aspirations.

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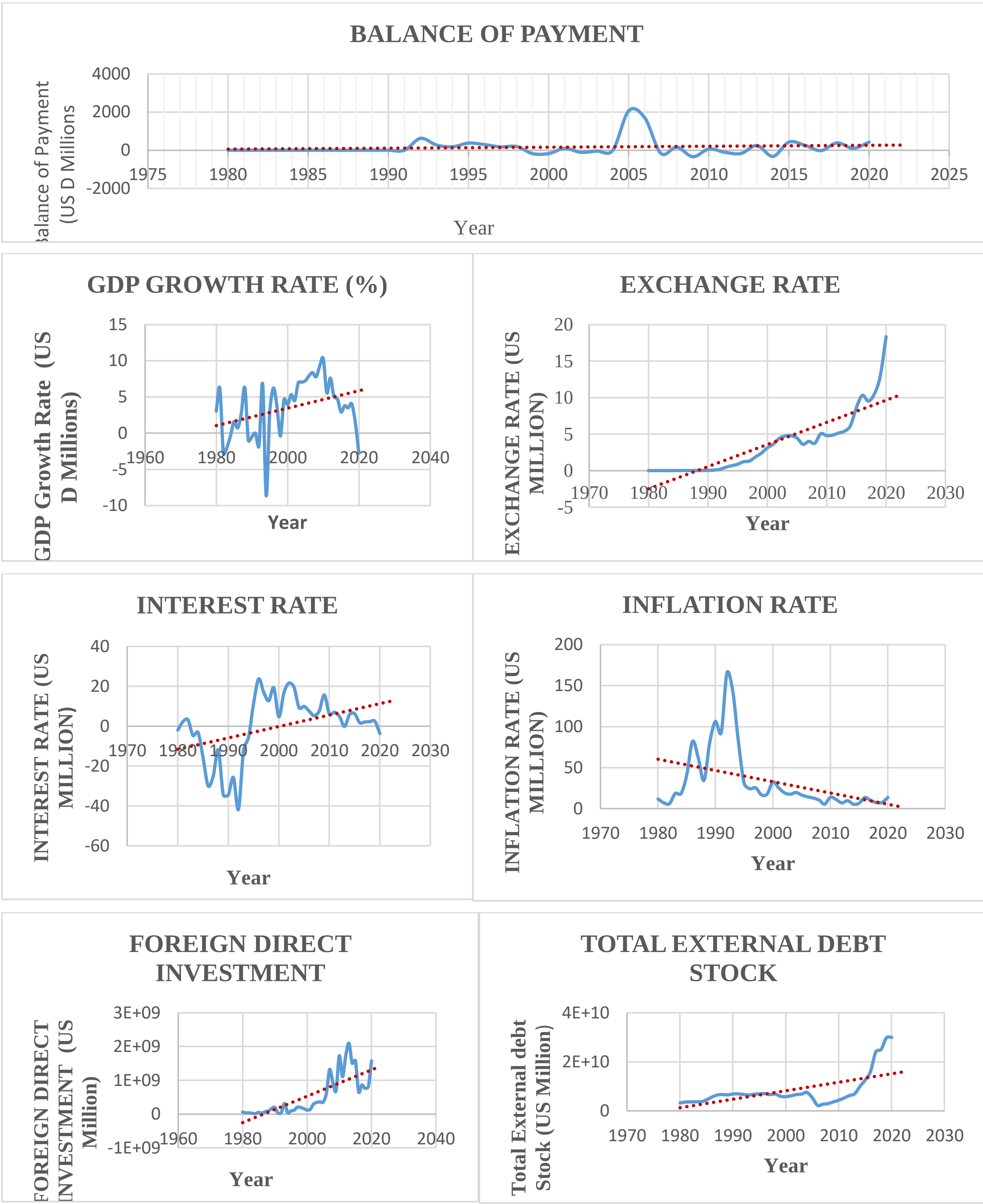
APPENDICES

APPENDIX 1: Graphical Illustration of Variables



APPENDIX 2: Vector Error Correction Model

Vector Error Correction Short Run Dynamics

	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
L	-.217	.089	-2.44	.015	-.391	-.043	**
LD	-.197	.262	-0.75	.453	-.711	.318	
L2D	-.292	.287	-1.02	.309	-.855	.271	
L3D	.08	.228	0.35	.724	-.366	.526	
LD	15.568	5.024	3.10	.002	5.722	25.415	***
L2D	7.507	6.178	1.22	.224	-4.603	19.616	
L3D	5.701	3.827	1.49	.136	-1.8	13.202	
LD	-.401	1.262	-0.32	.751	-2.874	2.073	
L2D	-.373	1.213	-0.31	.758	-2.75	2.004	
L3D	2.738	1.214	2.25	.024	.358	5.119	**
LD	.893	1.874	0.48	.634	-2.78	4.566	
L2D	.926	1.591	0.58	.561	-2.192	4.043	
L3D	-1.527	1.607	-0.95	.342	-4.678	1.623	
LD	-3.622	5.074	-0.71	.475	-13.568	6.323	
L2D	-10.959	4.885	-2.24	.025	-20.533	-1.384	**
L3D	.779	4.129	0.19	.85	-7.314	8.871	
LD	-6.638	4.179	-1.59	.112	-14.829	1.552	
L2D	-2.178	2.14	-1.02	.309	-6.372	2.017	
L3D	-1.588	1.308	-1.21	.225	-4.15	.975	
LD	-.752	1.15	-0.65	.513	-3.005	1.501	
L2D	-1.051	1.062	-0.99	.322	-3.132	1.03	
L3D	-1.523	1.071	-1.42	.155	-3.623	.577	
Constant	-.037	.885	-0.04	.967	-1.77	1.697	

Mean dependent var	1.194	SD dependent var	0.827
Number of obs	37.000	Akaike crit. (AIC)	.

*** p<.01, ** p<.05, * p<.1

Vector Error Correction Long Run Dynamics

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	6	261.353	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
_ce1						
log_bop	1	.	.	.	.	.
log_ex	9.427877	1.18445	7.96	0.000	7.106398	11.74936
log_fdi	5.975917	1.689377	3.54	0.000	2.664799	9.287035
log_inf	22.06049	1.676574	13.16	0.000	18.77446	25.34651
log_ec	-36.92699	3.388058	-10.90	0.000	-43.56747	-30.28652
log_gdp	-56.27747	4.815932	-11.69	0.000	-65.71652	-46.83841
log_int	-3.779234	1.402877	-2.69	0.007	-6.528822	-1.029647
_cons	753.1974	.	.	.	.	.