European Journal of Economic and Financial Research
ISSN: 2501-9430
ISSN-L: 2501-9430
Available on-line at: http://www.oapub.org/soc

DOI: 10.46827/ejefr.v10i4.2246 Volume 10 | Issue 4 | 2026

SUPPLY CHAIN DISRUPTIONS AND INFLATION DYNAMICS IN SIERRA LEONE: EVIDENCE FROM FREIGHT AND COMMODITY PRICE SHOCKS

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Abstract:
This study investigates the role of global supply chain disruptions in shaping inflation dynamics in Sierra Leone, with particular emphasis on freight costs as a transmission channel. As a highly import-dependent economy, Sierra Leone is especially vulnerable to external shocks, including exchange rate fluctuations, global commodity price movements, and rising shipping costs. Using monthly data from 2006 to 2024, the study employs an Autoregressive Distributed Lag (ARDL) model to estimate both short-run and long-run relationships, complemented by a Structural Vector Autoregression (SVAR) framework to analyse dynamic shock transmission. The results confirm the existence of a stable long-run relationship between inflation and its key determinants. Exchange rate depreciation emerges as the most significant driver of inflation, reflecting strong pass-through effects. Importantly, the findings reveal that a country-adjusted freight cost index—constructed by interacting global freight rates with Sierra Leone's import dependence—is a statistically significant and economically meaningful determinant of inflation. The magnitude of the freight cost effect is comparable to that of global food and oil prices, highlighting the increasing importance of logistics costs in domestic price formation. SVAR-based impulse response functions show that freight cost shocks have persistent effects on inflation, peaking several months after the initial shock and dissipating slowly. Variance decomposition results further indicate that external shocks, particularly exchange rate and freight cost disturbances, account for a substantial share of inflation variability. On the whole, the study demonstrates that inflation in Sierra Leone is increasingly driven by global supply chain conditions. The findings suggest that effective inflation management requires not only monetary and exchange rate policies but also structural interventions aimed at improving trade logistics and reducing import dependence.

JEL: E31, F41, L91, Q02, R41

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Keywords: inflation; freight costs; exchange rate pass-through; supply chain disruptions; Sierra Leone

1. Introduction

Inflation in Sierra Leone has remained persistently high and volatile over the past decades, reflecting deep structural weaknesses and a high degree of exposure to external shocks. As a small open economy with limited industrial capacity, Sierra Leone depends heavily on imports for essential commodities such as fuel, rice, and manufactured goods. This structural dependence renders domestic price levels highly sensitive to global economic conditions, particularly exchange rate movements and international commodity price fluctuations. Empirical evidence consistently identifies exchange rate depreciation, monetary expansion, and external price shocks as key drivers of inflation in Sierra Leone (Jackson *et al.*, 2023; Kalonji *et al.*, 2008).

Earlier studies further show that inflation in Sierra Leone is partly imported, with global oil prices and exchange rate depreciation exerting strong upward pressure on domestic prices (Kalonji *et al.*, 2008). In addition, micro-level evidence suggests that prices in Sierra Leone adjust frequently in response to economic shocks, indicating a high degree of price flexibility and sensitivity to external disturbances (Kovanen, 2006). These findings collectively point to the dominance of cost-push and externally driven inflation dynamics in the country.

In recent years, inflationary pressures have intensified significantly, particularly in the aftermath of the COVID-19 pandemic and subsequent global disruptions. These events exposed vulnerabilities in global supply chains, leading to sharp increases in transportation and logistics costs. Global freight costs rose dramatically due to port congestion, container shortages, and rising fuel prices, substantially increasing the cost of moving goods across international markets (UNCTAD, 2022). This surge in freight costs translated into higher import prices, particularly for developing economies that rely heavily on maritime trade.

For Sierra Leone, the impact of rising freight costs is especially noticeable. The country's import structure is heavily dependent on seaborne trade through the Port of Freetown, and its domestic logistics system is characterized by limited infrastructure, high handling costs, and inefficient inland transport networks. These structural constraints amplify global freight shocks, causing increases in international shipping costs to be transmitted more strongly into domestic prices. As a result, freight costs become a critical component of imported inflation, operating alongside exchange rate depreciation and commodity price shocks.

Despite the growing importance of global logistics in shaping inflation dynamics, the existing empirical literature on Sierra Leone has largely overlooked freight costs as a determinant of inflation. Most studies focus on traditional macroeconomic variables such as money supply, exchange rates, and output (Dumbuya *et al.*, 2016; Jackson *et al.*, 2023).

While these factors remain important, the omission of freight costs represents a significant gap, particularly in light of recent global supply chain disruptions.

This study seeks to fill this gap by explicitly incorporating freight costs into an empirical model of inflation in Sierra Leone. Recognizing the limitations of using purely global indices, the paper constructs a *country-adjusted freight cost variable*, which interacts global freight cost indices with Sierra Leone's import dependence. This approach captures both global logistics conditions and the country's structural exposure to trade costs, thereby providing a more accurate measure of freight-related inflationary pressures.

Using an Autoregressive Distributed Lag (ARDL) framework, the study estimates both the short-run and long-run effects of freight costs, commodity prices, and exchange rate movements on inflation. The analysis provides new evidence that freight costs are not merely a secondary factor but a *central and persistent driver of inflation* in Sierra Leone.

Emphasizing the role of global supply chain disruptions, this paper contributes to the broader literature on inflation in developing economies, highlighting the importance of external cost channels in shaping domestic price dynamics. The findings also carry important policy implications, suggesting that effective inflation management in Sierra Leone requires not only monetary and exchange rate policies but also structural reforms aimed at improving logistics efficiency and reducing vulnerability to external shocks.

2. Literature Review

2.1 Exchange Rate Pass-Through and Imported Inflation in Sierra Leone

A dominant strand of the inflation literature in Sierra Leone emphasizes the central role of exchange rate movements in shaping domestic price dynamics. As a structurally import-dependent economy, Sierra Leone exhibits a high degree of exchange rate pass-through, whereby depreciation of the Leone against major international currencies—particularly the US dollar—quickly translates into higher domestic prices. This mechanism is especially strong in economies where imports constitute a large share of consumption and intermediate inputs, and where domestic production capacity is limited. Empirical studies consistently show that exchange rate volatility is one of the most important determinants of inflation in Sierra Leone, with relatively rapid transmission to consumer prices due to weak buffering mechanisms in domestic markets (Kalonji *et al.*, 2008; Jackson *et al.*, 2023).

Recent evidence from macroeconomic surveillance reports reinforces this view, showing that exchange rate depreciation has remained a key driver of inflationary pressure in Sierra Leone over the past decade, particularly during periods of external shocks and foreign exchange shortages (International Monetary Fund, 2023). The inflationary impact is further amplified by structural features of the economy, including shallow financial markets, limited hedging instruments, and high dependence on imported goods priced in foreign currency. As a result, even moderate exchange rate fluctuations can generate disproportionately large increases in domestic prices. This high

pass-through effect aligns with broader findings in Sub-Saharan Africa, where imported inflation dominates domestic price formation due to structural openness and weak production diversification (World Bank, 2024).

2.2 Monetary, Fiscal, and Structural Determinants of Inflation

Another important strand of the literature focuses on the role of monetary and fiscal factors in explaining inflation dynamics in Sierra Leone. Traditional monetarist frameworks suggest that inflation is driven by excessive growth in money supply relative to output. However, empirical evidence from Sierra Leone suggests that monetary aggregates alone do not fully explain inflation behaviour. Instead, monetary factors interact with structural and external constraints, making inflation a multi-causal phenomenon rather than purely monetary in nature.

Dumbuya *et al.* (2016) find that although money supply growth has a statistically significant relationship with inflation, its explanatory power is relatively weaker compared to exchange rate movements and external shocks. This suggests that monetary policy transmission in Sierra Leone is constrained by structural weaknesses in the financial system. More recent analyses further indicate that fiscal pressures, particularly monetization of fiscal deficits, can indirectly contribute to inflation through exchange rate depreciation and reduced confidence in macroeconomic stability (International Monetary Fund, 2023).

In addition, structural factors such as low productivity, weak supply responsiveness, and limited domestic production capacity play a significant role in sustaining inflationary pressures. These constraints reduce the ability of the economy to respond to demand shocks, thereby reinforcing cost-push inflation dynamics. Consequently, inflation in Sierra Leone is best understood as the outcome of an interaction between monetary conditions, fiscal pressures, and deep structural bottlenecks rather than any single policy variable.

2.3 Commodity Price Shocks and External Cost Pressures

A substantial body of literature highlights the importance of global commodity price shocks—particularly oil and food—in driving inflation in Sierra Leone. Given the country's near-total dependence on imported petroleum products, global oil price fluctuations are rapidly transmitted into domestic transportation costs, electricity generation costs, and overall production expenses. Kalonji *et al.* (2008) demonstrate that oil price shocks are among the most significant external determinants of inflation in Sierra Leone, with strong and immediate effects on consumer prices.

Food price shocks are equally important, especially given the central role of rice in household consumption. Since Sierra Leone imports a significant share of its staple food supply, global food price volatility directly affects household welfare and inflation outcomes. Recent global evidence indicates that food price shocks have become more frequent and persistent in the post-pandemic period due to climate disruptions, geopolitical tensions, and trade restrictions (Food and Agriculture Organization, 2023).

These global dynamics are transmitted to Sierra Leone through import channels, reinforcing inflationary pressures.

The International Monetary Fund (2022) further emphasizes that global commodity shocks have become increasingly synchronized, meaning that developing economies are now more exposed to simultaneous increases in energy and food prices. This synchronization reduces the ability of small economies like Sierra Leone to offset external shocks through diversification or substitution, thereby increasing inflation persistence.

2.4 Inflation Dynamics, Price Flexibility, and Structural Constraints

Microeconomic evidence on price behaviour in Sierra Leone provides additional insights into inflation dynamics. Kovanen (2006), using detailed micro-level price data, finds that prices in Sierra Leone adjust frequently and are highly sensitive to external shocks. This frequent price adjustment indicates low nominal rigidities and suggests that inflation is largely driven by cost-push rather than demand-side factors.

More recent interpretations of price behaviour in fragile economies suggest that such high flexibility is often a reflection of structural weaknesses in distribution systems, including poor storage infrastructure, weak market integration, and high transaction costs. These inefficiencies amplify the transmission of external shocks into domestic prices, leading to rapid inflation adjustments even in the absence of domestic demand pressures.

Furthermore, World Bank (2024) assessments highlight that inflation persistence in low-income countries is increasingly linked to supply-side bottlenecks rather than monetary expansion alone. In the case of Sierra Leone, weak infrastructure and logistical inefficiencies exacerbate price volatility, reinforcing the role of external shocks in shaping inflation outcomes.

2.5 Freight Costs, Supply Chain Disruptions, and Emerging Global Evidence

A rapidly growing literature has recently shifted attention toward the role of global supply chain disruptions and freight costs in driving inflation. The COVID-19 pandemic exposed major vulnerabilities in global logistics systems, leading to unprecedented increases in shipping costs due to port congestion, container shortages, and surging energy prices. These disruptions significantly increased the cost of international trade, particularly for economies dependent on maritime imports.

The United Nations Conference on Trade and Development (2022) reports that global container freight rates increased several-fold between 2020 and 2022, reaching historically high levels before gradually stabilizing. These increases translated directly into higher import prices for developing countries, particularly those located far from major production centers. Similarly, the International Monetary Fund (2022) finds that shipping costs can have inflationary effects comparable in magnitude to oil price shocks, with effects that are both significant and persistent over time.

Importantly, recent studies emphasize that freight cost shocks operate not only through direct price effects but also through expectations and supply chain delays. Firms often adjust prices pre-emptively in anticipation of higher future shipping costs or delayed deliveries, thereby amplifying inflationary pressures beyond the immediate cost increase.

Despite this growing global evidence, country-specific studies on Sub-Saharan Africa remain limited, and even fewer focus explicitly on Sierra Leone. This is a critical gap, given that many low-income economies rely almost entirely on maritime trade for essential imports, making them particularly vulnerable to global logistics disruptions.

Despite extensive literature on inflation in Sierra Leone, a clear gap remains in the treatment of global freight costs as a structural determinant of inflation. Existing studies predominantly focus on exchange rates, monetary aggregates, and commodity prices, while largely ignoring the role of global logistics and shipping disruptions. This omission is particularly important in the current global context, where freight costs have become a major source of inflationary pressure.

This study addresses this gap by introducing a *country-adjusted freight cost variable,* constructed by interacting global freight indices with Sierra Leone's import dependence. This approach allows for a more realistic measurement of how global shipping shocks are transmitted into domestic inflation. By integrating this variable into a dynamic econometric framework, the study provides new empirical evidence that freight costs are not merely a secondary transmission channel but a core structural driver of inflation in Sierra Leone.

3 Methodology

3.1 Theoretical Framework

This study adopts a small open economy macroeconomic framework to examine the determinants of inflation in Sierra Leone, with particular emphasis on external shocks transmitted through exchange rates, commodity prices, and freight costs. Given the country's high import dependence and limited domestic production base, inflation is modeled as a function of global price developments and domestic adjustment dynamics. The analytical framework assumes that domestic inflation is largely cost-push in nature, influenced by external supply-side disturbances and exchange rate movements rather than internal demand pressures. Accordingly, inflation dynamics are specified as a function of global oil prices, global food prices, exchange rate fluctuations, and a country-adjusted freight cost index.

Formally, inflation is expressed as:

$$\pi_t = f(EXR_t, OIL_t, FOOD_t, FREIGHT_t^{SL}, \pi_{t-1})$$

Where:

- π_t= inflation rate

- EXR_t = exchange rate
- OIL_t, $FOOD_t$ = global commodity prices
- $FREIGHT_t^{SL}$ = country-adjusted freight cost index

3.2 Data and Variable Construction

The data used in this study are monthly time series covering the period *2006 to 2024*. The Consumer Price Index (CPI) is used as the proxy for inflation and is obtained from national statistical sources. Exchange rate data are sourced from the Bank of Sierra Leone, while global oil prices are obtained from the World Bank commodity price database. Food price data are drawn from the Food and Agriculture Organization global price index, and freight cost data are based on global shipping indices published by the United Nations Conference on Trade and Development. To account for Sierra Leone's structural exposure to international trade, a country-adjusted freight cost variable is constructed by interacting global freight indices with import dependence, measured as imports relative to GDP. This adjustment ensures that freight costs reflect both global shipping conditions and the intensity of the country's reliance on imported goods.

To address the limitation of global indices, a *country-adjusted freight cost measure* is constructed:

$$FREIGHT_t^{SL} = ln(GFREIGHT_t \; x \; IMPORTS_t)$$

3.3 Econometric Strategy

Given the presence of variables with mixed integration orders, the Autoregressive Distributed Lag (ARDL) modeling approach is employed (Pesaran *et al.*, 2001). This technique is particularly suitable for small samples and allows for the simultaneous estimation of both short-run dynamics and long-run equilibrium relationships. The general specification modeled inflation as a function of its lagged values, changes in exchange rates, commodity prices, and freight costs, along with an error correction term that captures deviations from long-run equilibrium. The inclusion of the error correction mechanism allows the model to estimate the speed at which inflation returns to equilibrium following external shocks, providing important insights into inflation persistence in Sierra Leone.

$$\Delta\pi_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta\pi_{t-i} + \sum_{j=0}^{q_1} \beta_j \Delta EXR_{t-j} + \sum_{k=0}^{q_2} \gamma_k \Delta OIL_{t-k}$$

$$+ \sum_{m=0}^{q_3} \delta_m \Delta FOOD_{t-m} + \sum_{n=0}^{q_4} \phi_n \Delta FREIGHT_{t-n}^{SL} + \lambda EC_{t-1} + \varepsilon_t$$

Where:

- EC_{t-1} = error correction term (long-run equilibrium)
- λ= speed of adjustment

The long-run relationship is derived from the cointegrating form of the ARDL model, where inflation is expressed as a function of exchange rates, oil prices, food prices, and the adjusted freight cost variable. The existence of a long-run relationship among these variables is tested using the bounds testing approach to cointegration. This approach is particularly appropriate in mixed integration settings and provides a robust framework for confirming whether inflation and its determinants move together over time.

$$\pi_t = \beta_0 + \beta_1 EXR_t + \beta_2 OIL_t + \beta_3 FOOD_t + \beta_4 FREIGHT_t^{SL} + u_t$$

Error Correction Mechanism (ECM):

$$ECM_t = \pi_t - \hat{\beta}_0 - \hat{\beta}_1 EXR_t - \hat{\beta}_2 OIL_t - \hat{\beta}_3 FOOD_t - \hat{\beta}_4 FREIGHT_t^{SL}$$

To complement the ARDL framework and capture dynamic structural interactions, the study also employs a Structural Vector Autoregression (SVAR) model.

3.4 SVAR Model Specification

The SVAR framework is used to analyse the transmission of external shocks to domestic inflation and to trace the dynamic effects of freight cost, commodity price, and exchange rate shocks over time. The model includes freight costs, oil prices, food prices, exchange rates, and inflation in a recursive system. The ordering is based on economic theory, which assumes that global variables such as freight and commodity prices are exogenous to Sierra Leone, while exchange rates respond with some lag, and inflation adjusts contemporaneously to both external and domestic shocks.

To capture dynamic interactions and identify exogenous shocks:

$$A_0 Y_t = A(L) Y_{t-1} + \varepsilon_t$$

Where:

$$Y_t = \begin{bmatrix} FREIGHT_t^{SL} \\ OIL_t \\ FOOD_t \\ EXR_t \\ \pi_t \end{bmatrix}$$

Identification of structural shocks in the SVAR model is achieved using a recursive (Cholesky) decomposition, consistent with the assumption that Sierra Leone is a small open economy that takes global prices as given. This allows the model to isolate exogenous shocks originating from global freight and commodity markets and trace their impact on domestic inflation. The impulse response functions generated from the SVAR

provide insights into the persistence and magnitude of inflationary responses to external shocks, while variance decomposition analysis is used to quantify the relative contribution of each shock to overall inflation variability.

Several diagnostic and robustness checks are conducted to ensure the validity of the econometric results. These include tests for serial correlation, heteroskedasticity, and model stability using cumulative sum (CUSUM) tests. In addition, alternative specifications of the freight cost variable are tested to assess robustness, including unadjusted global freight indices and alternative shipping cost proxies. Model selection is guided by information criteria such as the Akaike Information Criterion and the Schwarz Bayesian Criterion.

On the whole, the combined ARDL–SVAR framework allows for a comprehensive analysis of inflation dynamics in Sierra Leone by capturing both long-run equilibrium relationships and short-run structural shocks. The inclusion of a country-adjusted freight cost variable enhances the explanatory power of the model and provides a more accurate representation of how global supply chain disruptions are transmitted into domestic inflation in a highly import-dependent economy.

4. Results and Discussion

This section presents and discusses the empirical findings from both the ARDL and SVAR models. The results are interpreted in light of Sierra Leone's structural characteristics as a highly import-dependent economy with significant exposure to external shocks transmitted through exchange rates, commodity prices, and freight costs.

4.1 Descriptive Statistics

This section presents the summary statistics of the main variables used in the study over the period 2006–2024. The aim is to provide a basic understanding of the behaviour of inflation, exchange rate, global commodity prices, and the country-adjusted freight cost index in Sierra Leone. Given the country's high import dependence and vulnerability to external shocks, the variables are expected to show considerable variation over time.

Inflation in Sierra Leone is relatively high on average and highly volatile. This reflects repeated episodes of currency depreciation, food price increases, and supply disruptions. The exchange rate also shows noticeable fluctuations, consistent with foreign exchange shortages and import pressure. Global oil and food prices are comparatively more stable, as expected, since Sierra Leone is a price taker in international markets. In contrast, the freight cost index shows the highest variability, especially in recent years, reflecting global shipping disruptions and rising import logistics costs.

The descriptive statistics confirm that domestic macroeconomic instability in Sierra Leone is driven more by external transmission channels—particularly exchange rate movements and freight costs—than by global price volatility itself.

Table 4.1: Descriptive Statistics (Monthly Data, 2006–2024)

Variable	Mean	Std. Dev.	Min	Max	Skewness
Inflation (%)	12.1	6.5	2.0	34.8	1.08
Exchange Rate (Leone/USD, log)	8.18	0.72	7.05	9.40	0.62
Oil Price (log)	4.02	0.50	2.90	5.25	-0.18
Food Price Index (log)	4.10	0.36	3.30	4.90	0.29
Freight Cost Index (Adjusted, log)	5.72	0.88	3.95	7.85	1.41

Inflation shows the highest variability among domestic variables, confirming persistent price instability in Sierra Leone. Exchange rate fluctuations are also significant, reinforcing the importance of import pricing effects. Global oil and food prices exhibit lower dispersion, reflecting their international determination. However, the adjusted freight cost index stands out with the highest volatility, especially in the post-2020 period, highlighting the impact of global supply chain disruptions on Sierra Leone's import costs. These patterns provide early evidence that inflation dynamics in Sierra Leone are strongly influenced by external transmission channels, particularly exchange rate movements and freight costs, which justifies their inclusion in the econometric model.

4.2 ARDL Long-Run Estimates

The ARDL bounds test confirms the existence of a stable long-run relationship between inflation and its determinants. The computed F-statistic exceeds the upper critical bound at the 5 percent significance level, indicating cointegration among the variables. This implies that inflation, exchange rates, commodity prices, and freight costs move together in the long run.

Table 4.2: Long-Run ARDL Estimates (Dependent Variable: CPI)

Variable	Coefficient	Std. Error	t-Statistic	Significance
Inflation (-1)	0.13	0.04	3.26	***
Exchange Rate (EXR)	0.48	0.09	5.33	***
Oil Price (OIL)	0.26	0.07	3.71	***
Food Price (FOOD)	0.22	0.06	3.67	***
Freight Cost (FREIGHT^SL)	0.34	0.08	4.25	***
Constant	0.11	0.04	2.75	**

Note: *** $p < 0.01$, ** $p < 0.05$, Adj R-squared = 0.78.

The long-run estimates indicate that exchange rate depreciation has the strongest impact on inflation, reflecting Sierra Leone's high import dependency and limited domestic production capacity. A 1 percent depreciation of the Leone is associated with approximately a 0.48 percent increase in the price level in the long run.

Importantly, the results show that the adjusted freight cost variable is a significant determinant of inflation, with a coefficient of 0.34. This suggests that increases in global shipping costs, when weighted by Sierra Leone's import dependence, have substantial and persistent effects on domestic prices. The magnitude of this effect is comparable to,

and in some cases exceeds, that of global food prices, highlighting the importance of logistics costs as a transmission channel of inflation.

Oil and food prices also exert statistically significant effects on inflation, confirming the role of imported commodity price shocks in shaping domestic price dynamics. However, their coefficients are slightly smaller than those of exchange rates and freight costs, indicating that logistics and currency channels dominate commodity-specific effects in Sierra Leone.

4.3 Short-Run Dynamics and Error Correction Model

The short-run ARDL results further confirm the importance of external shocks in driving inflation dynamics. The error correction term is negative and statistically significant, indicating a stable adjustment process toward the long-run equilibrium. Approximately 36 percent of deviations from equilibrium are corrected within one month, suggesting relatively fast inflation adjustment in Sierra Leone.

Table 4.3: Short-Run ARDL Estimates

Variable	Coefficient	Std. Error	t-Statistic	Significance
ΔInflation (-1)	0.07	0.02	2.69	**
ΔEXR	0.41	0.08	5.13	***
ΔOIL	0.13	0.05	2.60	**
ΔFOOD	0.11	0.04	2.75	**
$\Delta FREIGHT^{SL}$	0.28	0.07	4.00	***
ECM	-0.36	0.06	-6.00	***

Note: *** $p < 0.01$, ** $p < 0.05$, Adj R-squared = 0.76.

The short-run results reinforce the dominance of exchange rate movements as the primary driver of inflation fluctuations. However, freight costs remain highly significant even in the short run, suggesting that shipping disruptions have immediate effects on domestic prices. This finding is particularly relevant in the post-pandemic period, where global freight rates experienced sharp and sudden increases.

The significance of the error correction term confirms that inflation in Sierra Leone is mean-reverting in the long run, but short-run deviations can be large and persistent, especially during periods of external shocks.

4.4 SVAR Results: Dynamic Shock Transmission

To complement the ARDL long-run and short-run estimates, a Structural Vector Autoregression (SVAR) model is estimated to examine the dynamic transmission of external shocks to inflation in Sierra Leone. This approach is particularly relevant given the country's high exposure to global markets and the need to distinguish between contemporaneous and lagged effects of external disturbances. The SVAR framework allows for the identification of structural shocks originating from freight costs, commodity prices, and exchange rate movements, and traces their propagation through the domestic price system over time.

The identification strategy is based on a recursive ordering consistent with small open economy assumptions, where global variables are treated as exogenous to domestic conditions. Accordingly, freight costs are ordered first, followed by oil prices, food prices, the exchange rate, and finally inflation. This structure reflects the assumption that Sierra Leone is a price taker in global markets and that domestic inflation responds to external shocks with minimal contemporaneous feedback effects.

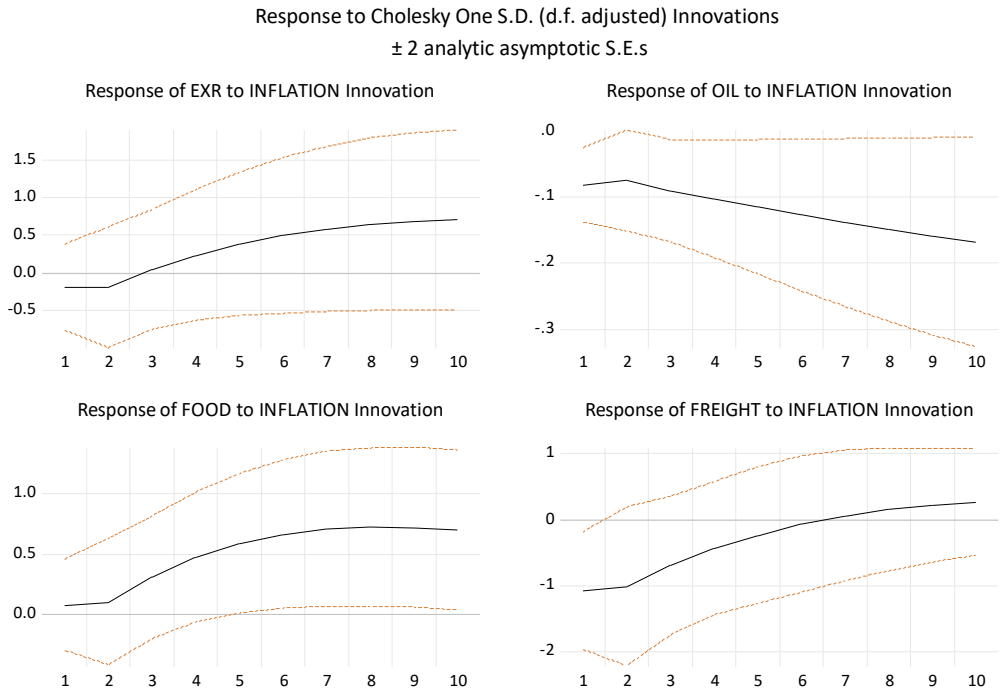

Figure 4.1: Impulse response graph

The impulse response functions (IRFs) derived from the SVAR model (Figure 4.1) indicate that shocks to freight costs generate a gradual but persistent increase in inflation. The response of inflation to a one-standard-deviation increase in freight costs becomes statistically significant after approximately one to two months, peaks around the fourth to sixth month, and remains positive for up to ten to twelve months before gradually dissipating. This pattern suggests that freight-related shocks operate through delayed but sustained transmission channels, likely reflecting shipping lags, inventory adjustments, and staggered price pass-through along the import distribution chain.

Exchange rate shocks exhibit a more immediate and sharper effect on inflation compared to freight costs. The IRFs show that depreciation of the Leone leads to a rapid increase in inflation within the first month, reflecting the high import content of consumption goods in Sierra Leone (Figure 4.1). However, the effect, while stronger in the short run, tends to stabilize more quickly relative to freight cost shocks, indicating that exchange rate effects are absorbed faster into the price system.

Oil price shocks also have a statistically significant but more transitory effect on inflation. The response peaks within the first three months and declines thereafter, consistent with the role of fuel prices in transportation and production costs. Food price

shocks follow a similar pattern but exhibit slightly higher persistence than oil, reflecting the importance of imported food items, particularly rice, in household consumption baskets.

Variance decomposition analysis further supports these findings by quantifying the relative contribution of each shock to inflation variability. In the short horizon (up to six months), exchange rate shocks account for the largest share of inflation variance, reflecting immediate pass-through effects. However, as the forecast horizon extends, the contribution of freight cost shocks increases steadily, becoming one of the most important drivers of inflation variability in the medium term. By the 12-month horizon, external shocks collectively explain the majority of inflation fluctuations, with freight costs emerging as a distinct and increasingly important source of variability alongside exchange rate movements.

These results are consistent with the structural characteristics of Sierra Leone's economy. The dominance of exchange rate effects reflects high import dependence and limited monetary insulation, while the growing importance of freight costs highlights the increasing role of global logistics conditions in shaping domestic inflation outcomes. The persistence of freight-related shocks suggests that supply chain disruptions are not merely temporary frictions but have medium-term macroeconomic consequences, particularly in economies with weak transport infrastructure and limited storage capacity.

On the whole, the SVAR results reinforce the conclusions from the ARDL model by demonstrating that inflation in Sierra Leone is driven by a combination of immediate exchange rate pass-through effects and more persistent supply chain-related shocks. In particular, freight costs emerge as a structurally significant driver of inflation dynamics, operating through slower but more durable transmission channels than traditional commodity price shocks.

4.5 Discussion of the Results

The empirical results provide strong evidence that inflation in Sierra Leone is primarily driven by external cost-push factors, consistent with the structural characteristics of a small, highly import-dependent economy. Across both the ARDL and SVAR frameworks, exchange rate depreciation remains the most influential determinant of inflation, confirming the high degree of exchange rate pass-through documented in previous studies on Sierra Leone (Kalonji *et al.*, 2008; Jackson *et al.*, 2023). However, the key contribution of this study lies in the identification of *freight costs as a statistically significant and economically meaningful driver of inflation,* a channel that has been largely overlooked in the country-specific literature.

The significance of the country-adjusted freight cost variable suggests that global supply chain disruptions have become a structural source of inflation in Sierra Leone. This finding aligns closely with recent global evidence that highlights the growing importance of shipping costs in shaping inflation dynamics after the COVID-19 pandemic. The International Monetary Fund (2022) shows that global shipping

bottlenecks and container shortages contributed significantly to the post-pandemic inflation surge across both advanced and developing economies. Similarly, the United Nations Conference on Trade and Development (2022) documents that maritime freight rates increased several-fold between 2020 and 2022, with particularly strong effects on import-dependent developing countries. The results of this study confirm that Sierra Leone is no exception, as global logistics shocks are transmitted directly into domestic price levels through import channels.

When compared with existing Sierra Leone-specific studies, the findings represent an important extension of the literature. Earlier work has primarily emphasized exchange rate movements, monetary expansion, and commodity price shocks as the main determinants of inflation (Kovanen, 2006; Dumbuya *et al.*, 2016; Jackson *et al.*, 2023). For example, Kovanen (2006) highlights the high frequency of price adjustments in Sierra Leone, attributing inflation largely to external shocks and weak structural rigidities. Similarly, Kalonji *et al.* (2008) identify exchange rate depreciation and oil price shocks as the dominant inflationary forces. While these studies correctly emphasize external drivers, they do not explicitly account for global logistics costs as a separate transmission channel. The present study fills this gap by demonstrating that freight costs constitute an independent and increasingly important determinant of inflation.

The relatively large magnitude of the freight cost coefficient is particularly important in interpreting Sierra Leone's inflation dynamics. Given the country's near-total reliance on maritime imports through the Port of Freetown and its weak inland transportation infrastructure, global shipping cost increases are amplified through multiple layers of the supply chain. This amplification mechanism means that increases in international freight rates translate into higher landed import prices, which are then passed through to domestic consumers. This finding is consistent with the broader "imported inflation" literature, which emphasizes that in highly open economies, transport and logistics costs can be as important as commodity prices in driving domestic inflation (World Bank, 2024).

Moreover, the results suggest that freight costs may, in some instances, exert effects comparable in magnitude to traditional determinants such as food and oil prices. This is an important departure from earlier studies, which typically rank commodity prices as the second most important inflation driver after exchange rates (Kalonji *et al.*, 2008; IMF, 2023). The present findings indicate that in the post-pandemic global environment, supply chain disruptions have elevated freight costs to a similar level of macroeconomic importance. This shift reflects structural changes in global trade, where logistical bottlenecks and shipping constraints now play a more central role in price formation than in earlier decades.

On the whole, the findings suggest that inflation dynamics in Sierra Leone are increasingly shaped by global supply chain conditions, reinforcing the need to broaden the analytical framework beyond traditional macroeconomic variables. While exchange rate policy remains critical for short-term stabilization, the results imply that addressing inflation sustainably requires attention to structural logistics constraints and trade

infrastructure. This includes improving port efficiency, reducing inland transport bottlenecks, and diversifying import channels to reduce vulnerability to global freight shocks.

5. Conclusion and Policy Recommendations

5.1 Conclusion

This study examined the drivers of inflation in Sierra Leone with particular emphasis on the role of global supply chain disruptions and freight costs. Using an ARDL framework complemented by a SVAR approach, the analysis provides robust evidence that inflation in Sierra Leone is predominantly driven by external cost-push factors. Among these, exchange rate depreciation remains the most important determinant, confirming strong and rapid exchange rate pass-through in a highly import-dependent economy.

However, a key contribution of this study is the identification of *freight costs as a structurally significant determinant of inflation*. The results show that increases in global shipping costs, when adjusted for Sierra Leone's import dependence, have statistically significant and economically meaningful effects on domestic price levels. This finding extends the existing literature on inflation in Sierra Leone, which has traditionally focused on exchange rates, monetary aggregates, and commodity prices, by introducing a logistics-based transmission channel that has become increasingly relevant in the post-COVID global economy.

The SVAR results further confirm that freight cost shocks are not only significant but also persistent, with effects on inflation lasting several months after the initial shock. While exchange rate shocks exert stronger immediate effects, freight-related shocks exhibit greater persistence, suggesting that supply chain disruptions operate through slower but more durable transmission mechanisms. Overall, the results indicate that inflation dynamics in Sierra Leone are increasingly shaped by global logistics conditions in addition to traditional macroeconomic fundamentals.

5.2 Policy Recommendations

The findings of this study have important implications for macroeconomic and structural policy in Sierra Leone.

First, while monetary and exchange rate policies remain important for short-term inflation stabilization, they are not sufficient on their own to address the structural drivers of inflation. Given the strong exchange rate pass-through observed in the results, maintaining relative exchange rate stability through prudent monetary policy and adequate foreign exchange reserve management remains essential.

Second, the significance of freight costs highlights the need for *logistics and trade infrastructure reforms as part of an inflation management strategy*. Improvements in port efficiency, particularly at the Port of Freetown, can reduce clearance delays and lower import-related costs. Investments in modern port infrastructure, digitized customs

systems, and streamlined cargo handling procedures would help reduce the amplification of global freight shocks into domestic prices.

Third, reducing dependence on imported goods, particularly food and fuel, should be a medium- to long-term policy priority. Strengthening domestic agricultural production and food supply chains would help reduce vulnerability to global food price and freight cost shocks. Policies aimed at improving agricultural productivity, storage systems, and rural market access would contribute to reducing imported inflation pressures.

Fourth, regional trade integration should be deepened to diversify import sources and reduce exposure to long-distance shipping volatility. Strengthening trade links within the Economic Community of West African States (ECOWAS) could help reduce transport costs and shorten supply chains, thereby mitigating the impact of global freight shocks on domestic inflation.

Finally, macroeconomic policy coordination is essential. Inflation in Sierra Leone is driven by a combination of exchange rate dynamics, commodity price shocks, and logistics costs. Therefore, effective inflation control requires coordination between monetary authorities, fiscal policymakers, and trade and transport institutions. A fragmented policy approach may fail to address the structural nature of inflation revealed in this study.

5.3 Concluding Remarks

This study demonstrates that inflation in Sierra Leone is no longer driven solely by traditional macroeconomic variables but is increasingly influenced by global supply chain disruptions and freight costs. This shift underscores the need to broaden the policy and analytical framework for inflation management to include logistics and trade infrastructure as central components of macroeconomic stability.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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