

## **Illicit financial flows in Mozambique's natural resource sector: The effect of macroeconomic factors**

**Fluxos financeiros ilícitos no setor de recursos naturais de Moçambique: O efeito de fatores macroeconômicos**

**Flujos financieros ilícitos en el sector de los recursos naturales de Mozambique: El efecto de los factores macroeconómicos**

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### **Abstract**

The study investigates the illicit financial flows from the natural resource sector in Mozambique with a particular focus on the effect of macroeconomic factors. Relying on quarterly time series data (2008Q1-2019Q4), the study adopted the ARDL estimation procedure and a granger causality test for the purpose of analysis. From the results, it was revealed that real exchange rate and government budget deficit have a significant and positive effect on illicit financial flows from the natural resource sector in the long run. However, the short-run inflation as well as the government budget deficit and external debt were found to influence the movement of illicit financial flows from the natural resource sector in Mozambique. Furthermore, granger causality results revealed a bidirectional effect moving between illicit financial outflows and external debt, and between control of corruption and illicit financial outflows.

**Keywords:** Illicit financial flows; Macroeconomic factors; Mozambique natural resource sector.

### **Resumo**

O estudo investiga os fluxos financeiros ilícitos do setor dos recursos naturais em Moçambique com um foco particular no efeito dos fatores macroeconómicos. Com base em dados de séries temporais trimestrais (2008Q1-2019Q4), o estudo adotou o procedimento de estimação ARDL e um teste de causalidade de Granger para fins de análise. Os resultados revelaram que a taxa de câmbio real e o déficit orçamentário do governo têm um efeito significativo e positivo sobre os fluxos financeiros ilícitos do setor de recursos naturais no longo prazo. No entanto, a inflação de curto prazo assim como o déficit orçamentário do governo e dívida externa influenciaram o movimento dos fluxos financeiros ilícitos do setor de recursos naturais em Moçambique. Além disso, os resultados de causalidade de Granger revelaram um efeito bidirecional entre saídas financeiras ilícitas e dívida externa, e entre controle da corrupção e saídas financeiras ilícitas.

**Palavras-chave:** Fluxos financeiros ilícitos; Fatores macroeconómicos; Setor de recursos naturais de Moçambique.

### **Resumen**

El estudio investiga los flujos financieros ilícitos del sector de recursos naturales en Mozambique con un enfoque particular en el efecto de los factores macroeconómicos. Basándose en datos de series temporales trimestrales (2008Q1-2019Q4), el estudio adoptó el procedimiento de estimación ARDL y una prueba de causalidad de Granger para fines de análisis. A partir de los resultados, se reveló que el tipo de cambio real y el déficit presupuestario del gobierno tienen un efecto significativo y positivo en los flujos financieros ilícitos del sector de los recursos naturales a largo plazo. Sin embargo, se descubrió que la inflación a corto plazo, así como el déficit presupuestario del gobierno y la deuda externa influyen en el movimiento de flujos financieros ilícitos del sector de recursos naturales en Mozambique. Además, los resultados de causalidad de Granger revelaron un efecto bidireccional que se mueve entre las salidas financieras ilícitas y la deuda externa, y entre el control de la corrupción y las salidas financieras ilícitas.

**Palabras clave:** Flujos financieros Ilícitos; Factores macroeconómicos; Sector de recursos naturales de Mozambique.

## 1. Introduction

Over the years, Illicit Financial Flows (IFF) has generated serious and genuine concerns among academics and leaders in the global development arena (see Kar and Spanjers, 2015; United Nations Conference on Trade and Development (UNCTAD), 2020). By definition, it is considered as the illegitimate movement of assets (money or capital) from one country to another (UNCTAD, 2020). Its engagement is largely derived from commercial activities in the form of tax evasion, trade misinvoicing and transfer pricing. Globally, the interest in IFF mainly draw from its ability to significantly slowdown growth and alter sustainable development, especially in the developing economies, through the shrinkage of foreign exchange, reduction of domestic resources, stifling of trade and macroeconomic stability and worsening of inequality and poverty (UNCTAD, 2020). Unfortunately, resources lost through IFF do not contribute to improving the social welfare of the residents in the resource-producing country (Škare & Sinković, 2013).

Although the phenomenon is global, the irony remains that the funds involved are leaving jurisdictions with economically scarce resources, weak resource mobilization, depleted foreign reserves and limited investment inflows (UNCTAD, 2020). Despite the global awareness of its negative consequences, IFF continues to grow. For instance, between 2004 and 2013, developing countries lost around \$800 billion annually through IFF (Kar and Spanjers, 2015). To put this into perspective, Combes et al. (2019) observed that the amount was more than the combined amount of Foreign Direct Investment (FDI), Official Development Assistant (ODA) and remittances that accrue to the developing world between the same periods. In the case of Africa, estimates show that the continent loses around \$30 to 52 billion, annually, through trade misinvoicing alone (UNCTAD, 2020) Meanwhile, if funds can be prevented from illicitly leaving the continent, Collier et al. (2001) estimated that the continent's annual stock of capital and Gross Domestic Product (GDP) per capita could rise by 60% and 15% respectively.

The most vulnerable and severely impacted by IFF are the small and developing economies like Mozambique in Southern Africa – a country well-endowed in mineral and natural resources such as natural gas, coal, heavy sands, and precious stones, and more recently, the discovered oil. However, jurisdictions associated with a huge endowment in mineral and natural resources (of which Mozambique is no exception) are often considered fertile grounds for tax evasion, trade misinvoicing and transfer pricing due to the volume of transactions involved in the extraction and export of these resources (United Nations Development Programme (UNDP), 2020), as well as the corruption level (Le Billion, 2011). A report on the Extractive Industry Transparency Initiative Mozambique (EITI, 2020) indicated that the revenues received by state institutions and the payments declared by the companies in 2019 constituted a difference of 0.17%. According to the Global Financial Integrity (GFI, 2014) report, between 2002 and 2010, the accumulated gross illicit flows from price manipulation in Mozambique totaled \$5.3 billion; averaging \$585 million annually. Furthermore, GFI (2014) pointed out that around \$2.3 billion of illicit capital flows lost was due to the adulteration of commercial invoices, which might have cost the government in the amount of \$1.68 billion in revenues.

Capital movement normally occurs as a consequence of economic agents' rational portfolio decisions (Collier et al., 2001). This decision, according to Dooley (1988), is primarily influenced by exchange rate duality, public sector indebtedness and political stability. Empirically, structural factors such as reform-induced growth rates and income inequality (Kar 2012) and institutional factors such as corruption and political stability (Slany et al., 2020; Kar and Cartwright-Smith, 2009) have been identified as determinants of IFF. Kar (2012) also noted that IFF can be explained by macroeconomic factors such as money supply, inflation, exchange rate and fiscal deficit. For example, asset holders can be motivated to transfer funds abroad if the level of inflation significantly reduces the value of illicit assets (Kar, 2012).

In line with the above discussion, the question for policymakers and governments is; why is the natural resource sector, which has the potential to transform natural resource-rich countries like Mozambique, experiencing a significant outflow of funds illegally? This question constitutes a major preoccupation for the researchers. Against this backdrop, the main focus of this paper is to investigate the effect of macroeconomic factors on IFF in the natural resource sector in Mozambique. The paper contributes to the literature by focusing on a sector-specific IFF, the natural resource sector, thereby, deviating from the general calculation of a country's IFF as in Kar (2012); Kar and Cartwright-Smith (2009). Again, to the best of the authors' knowledge, this will be the first paper with a sole focus on IFF in Mozambique. Hence, the paper is mainly driven by the following research questions;

- i. What are the effects of macroeconomic factors on the natural resources sector IFF in Mozambique?
- ii. Is there any causality between IFF and macroeconomic factors?

Finally, the study proceeds as follows: section Two focus on the review of literature; section Three presents an overview of the mining resources in Mozambique and the economy; section Four provide analysis on the methodology; section Five focus on the presentation and discussion of results; while the conclusion and recommendation are presented under section Five.

## 2. Literature Review

Theoretically, capital movements can be explained by the portfolio choice theory, investment diversion theory or debt-driven theory. In brief, the portfolio choice theory postulates that capital movement might occur as a result of economic agents' desire to maximize capital yields against a given risk level (Collier et al., 2001). The decision to transfer capital abroad is contingent on the risk-adjustment returns in the domestic economy and the foreign economy and reflects a response strategy to changes in agents portfolio bundle. According to Dooley (1988), this decision might be influenced by macroeconomic indicators such as exchange rate, indebtedness and political stability. The investment diversion theory suggests that due to weak macroeconomic and political conditions, investors might be tempted to transfer funds to advanced economies. This would cause the assets and capital of the domestic country to be eroded, thus reducing the country's financing capacity for development. The debt-driven theory posited that capital transfer could be a response factor to changing economic conditions mainly influenced by external debt (Boyce, 1992).

On the empirical front, several factors have been considered to affect the movement of financial flows including illicit financial flows. Prominent among the factors are macroeconomic and institutional (Tarawalie & Jalloh, 2021; Slany et al., 2020; Signé et al., 2020; Anrtor, 2019; Letete & Sarr, 2017; Brada et al., 2013; Kar, 2012, 2011; Kar & Cartwright-Smith, 2009; Ndikumana & Boyce, 2003; Dooley, 1988). However, it appears that a deteriorating macroeconomic environment is considered the most important determinant of IFF (Mossadak, 2018).

From the literature, financial deficit (a source of government budget deficit), public debt, trade openness, the shadow economy, real GDP, inflation and exchange rate were identified as the key macroeconomic indicators that explain IFF. For example, a high level of inflation could reduce the value of assets that are denominated in the local currency. In comparison, it makes them relatively less attractive to other assets denominated in other foreign currencies. In the end, this could induce rational economic agents to acquire foreign assets in legal or illegal ways (Mossadak, 2018; Kar, 2012). Similarly, high levels of indebtedness can increase the possibility of a debt crisis that could arise from a country's deteriorating solvency situation. In such a situation, investors might be tempted to shift capital abroad which can encourage IFF. Tarawalie and Jalloh (2021) echoed this in their study. Using an Autoregressive Distributed Lag (ARDL) estimation procedure, their results found the flight of capital to increase with external debt. Meanwhile, Anetor (2019) established that economic growth and external debt constitute the main macroeconomic factors to influence the movement of capital outside Africa.

Furthermore, et al., (2013) noted that any increase in government budget deficit is, often accompanied by the deterioration of other macroeconomic indicators like higher interest rates, higher inflation and the depreciation of the exchange rate. In this sense, a positive correlation is expected between the budget deficit and the illicit financial flow. The budget deficit is a channel of IFF, which leads to less social spending on health, education, and infrastructure for the socially and economically disadvantaged population (Ortega et al., 2020).

Again, an economy with serious exchange rate devaluation or depreciation is likely to have less valuable domestic assets, thus, leading to or encouraging IFF. Findings are, however, not consensual, and often differs in terms of significance. For instance, Letete and Sarr (2017) examined IFF in Kenya and found the outflow of IFF to share a significantly positive relationship with the rate of inflation, debt and government expenditure while finding GDP and exchange rate to be insignificant in explaining IFF outflows. In a similar study, Signé et al. (2020), found higher inflation, GDP and higher taxes to increase the outflow of IFF in Africa. The authors further suggested that the majority of the financial movement leaving Africa illegally ends up in countries like China, the United States of America and the United Kingdom. However, unlike Letete and Sarr (2017) and Signé et al. (2020), Kar (2011) and Mossadak (2018) failed to observe any significant relationship between inflation and IFF for India and Africa respectively.

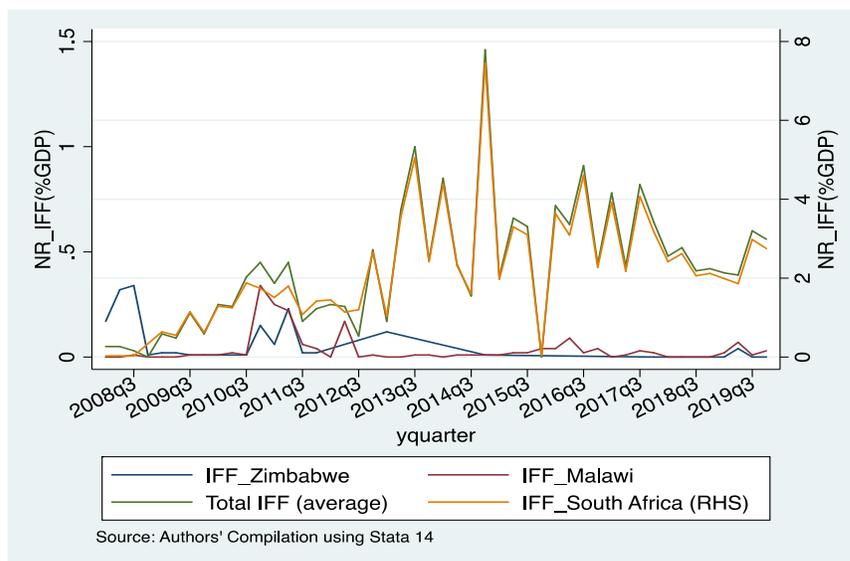
Equally, the level of institutional quality on IFF has also been stressed in the literature. Sound institutions are critical for curtailing illegal capital movement and this can create a business environment with less uncertainty. For instance, Osei-Assibey et al. (2018) noted that funds normally move out of a country in fear that the corrupt government will be unable to provide a conducive investment climate. The higher the level of corruption, the more likely economic agents are to partake in IFF, and this has been empirically observed by Osei-Assibey et al. (2018), Everest-Phillips (2012) and Le and Rishi (2006). Aside from corruption, in periods of political instability, IFF is likely to increase (Signé et al., 2020; Mossadak, 2018). This is normal because under such an environment the whole institutional structure is likely to become nonfunctional, hence, making it crucial in combating IFF. On the other hand, Orkoh et al. (2018) found that an increase in political stability and corruption control reduce illicit financial outflow in Sub-Saharan Africa countries.

### **3. Mining Resources and National Economy: An Overview**

With the implementation of large coal and gas projects in the country, the extractive sector has made significant contributions to the country's economic growth. Since 2004, a number of mining projects have been initiated, including the Kenmare heavy sands project, the Vale and Rio Tinto coal mines, and most recently, the successful gas exploration by Ente Nazionale Idrocarburi (ENI) and Anadarko in the Rovuma basin on the north coast of Mozambique. From the set of economic activities that contribute to the Mozambique's GDP, the mining industry stands out. Data from the National Institute of Statistics (INE) indicate that the contribution of the extractive industry to GDP in 2017 was 1.7% followed by the agriculture sector with 0.9% in the same period. In terms of state revenues, the extractive industry contributed 17% and 9% of revenues collected between 2017 and 2018 respectively (EITI, 2020). The contributions of coal and gas to GDP growth are estimated to be in average of 2% points per year between 2013 and 2023 (IMF, 2014). World Bank (2014) estimates indicate that by 2032, Mozambique could generate up to US\$9 billion in revenue from its natural resources, in particular coal and gas, representing 7% and 21% of GDP of total government revenue, respectively. Although the benefits of the extractive sector to the economy growth is telling, the Government of Mozambique (GoM) is concerned with the amount of capital lost illicitly. For instance, the GoM in the First Voluntary National Review Report on the SDGs (2020) to the United Nations High-Level Political Forum included in its short (2018-2021) and medium-term (2022-2025) interventions to increased export revenue of raw materials and reduce illicit flows to an expected short-term benefit

of 3% in GDP and 2% in GDP in the medium term. Figure 1 show trends in natural resource illicit financial outflows (NR\_IFF) as shares of the national GDP.

**Figure 1:** Natural resources illicitly financial outflows shares on GDP.



Source: Authors.

From the Figure 1, it is evident that the trend in illicit financial outflows from Mozambique's natural sector has fluctuated largely over time. Although with some periods of NR\_IFF reduction, the increasing pattern of NR\_IFF shares of GDP persists. The first major record of NR\_IFF shares was in 2010Q4 which meant 0.45% of GDP. In 2013Q3 there was a significant reduction in the share of the NR\_IFF by 0.10% on the GDP. However, this reduction did not last long. In 2013Q3, the share of NR\_IFF increased by 1.0%. Between 2008Q1 e 2019Q4 the highest share was recorded in 2014Q4 (1.46%) while averaging 0.44%.

Meanwhile, it was also observed from Figure 1 that the NR\_IFF that move to South Africa dominate the total shares on GDP. South Africa contributes to Mozambique's GDP mainly through its large investment in the natural gas sector. South Africa stands out for its geographical location and logistical capacity to handle large volumes of natural resources. Trades of natural resources, principally coal, are made at Maputo and Matola ports in Mozambique and the port of Richards Bay in South Africa. The movement of cargo between the two countries is done mostly by land with allows large volumes of traded resources per month. However, N\_IFF to Malawi and Zimbabwe are relative less.

#### 4. Methodology

In response to the aforementioned research questions, the study relied on the Autoregressive Distributed Lag (ARDL) model and Granger Causality tests, respectively. The ARDL method has the advantage of being robust and of performing better in small samples (Latif et al., 2015), thus making it suitable for this research. Besides, it allows for variable relationships to be tested even when the variables are of a different order of integration I(1) or I(0) (Pesaran et al., 2001). With that said, the study employs quarterly time series data for Mozambique from 2008Q1 to 2019Q4, representing a sample of 44 observations. The data were sourced from the International Monetary Fund (IMF) database, the International Trade Centre (ITC) and the World Bank database. The model for the study is specified as:

$$IFF\_ \%GDP_t = \omega_0 + \sum_{i=1}^N \varphi_s^i Macro_t^i + \sum_{j=1}^N \varphi_r^j CV_t^j + \varepsilon_t \quad (1)$$

Where:  $IFF\_ \%GDP_t$  is the natural resources Illicit Financial Flows (% GDP) from the natural resource sector in Mozambique at time t,  $Macro_t^i$  are the macroeconomic variables i (Inflation rate; real effective exchange rate; external debt and government budget deficit) at time t, and  $CV_t^j$  are the control variables j (control of corruption and political stability) at time t, with  $\omega_0$ ,  $\varphi_s^i$ ,  $\varphi_r^j$  and  $\varepsilon_t$  representing the intercept, parameters to be estimated and the random error term respectively.

In line with UNCTAD (2020) and Ndikumana and Boyce (2018), illicit financial flow is calculated using the Partner-Country trade gap approach as shown in equation (2). The equation denotes the difference between imports by partner j from country i as recorded by partner j ( $M_{ji}$ ) and exports by country i to partner j as recorded by country i ( $X_{ij}$ ) while correcting for Cost, Insurance and Freight (CIF),  $\beta$ . Although CIF varies widely across countries distance and transactions, IMF (2018) recommends a uniform 6 per cent on the export value for the calculation of trade gaps. Besides, it is suggested that for natural resources, the CIF is close to 6 per cent (IMF, 2018). The partner countries considered in this study are: South Africa, Zimbabwe and Malawi<sup>1</sup>. Worth noting is that the correcting factor for CIF ( $\beta$ ) is usually set at 1.1 (including 6 per cent of export value proxy for CIF) (UNCTAD, 2020).

$$DX_{it} = \sum_{j=1, k=1}^{jk} (M_{ji,t}^k - \beta X_{ij,t}^k) \quad (2)$$

In equation (2), DX captures statistical and logistical errors in mirror trade data, as well as intentional export misinvoicing. Negative values of export misinvoicing (DX) were not linked to IFFs because, according to UNCTAD (2020), illicit financial inflows in the context of extractive industries in Africa is counterintuitive; and large negative trade gaps are likely to be linked to the characteristics of specific primary commodities and their trade patterns (such as coal storage in our study). As such, only positive values of export misinvoicing can be an indicator of illicit financial outflows. Therefore, and in line with UNCTAD (2020), to capture only illicit financial outflows the negative values are set to zero.

### **Autoregressive distributed lag approach**

For analysis, some variables at levels were transformed into natural-log. The log-linear transformation normalizes the data distribution by reducing the variability in the data and provides reliable results (Khan 2020). To this end,, equation (1) is re-written in the functional form as follows:

$$IFF\_ \%GDP_t = \varphi_0 + \varphi_1 \ln f_t + \varphi_2 R.Ex.Rate_t + \varphi_3 \ln Ext.Debt_t + \varphi_4 Gov.Budget Def_t + \varphi_5 Cont.Corruption_t + \varphi_6 Pol.stability_t + u_t \quad (3)$$

Where  $IFF\_ \%GDP$  is the natural resource illicit financial outflows (%GDP) from the natural resource sector in time t;  $\ln f_t$  denote the inflation at time t;  $Ex.Rate_t$  stand for real exchange rate at time t;  $\ln Ext.Debt_t$  is the natural log of external debt in time t;  $Gov.Budget Def_t$  is the Mozambican government budget deficit at time t;  $Cont.Corruption_t$  correspond to the Mozambican control of corruption index at time t;  $Pol.Instability_t$  is the political stability index in Mozambique at time t and  $u_t$  is the error term. Worthy of note is that, similar to Luu et al. (2018), the study rescaled the control of corruption and political stability index from -2.5 (worst) to 2.5 (best) to 0 (worst) to 100 (best) using the formula  $X = (a + 2.5) \times 20$  where X is the new rescaled value and a is the original scale value.

<sup>1</sup> These countries were considered based on their trade with Mozambique, as well as, the availability of data.

In the ARDL method the long-run linear relationships between the variables are examined by applying the bounds testing approach of cointegration, has presented in following equations:

$$\begin{aligned} \Delta IFF\_ \%GDP_t = & \varphi_0 + \varphi_1 Inf_{t-1} + \varphi_2 Ex. Rate_{t-1} + \varphi_3 lnExt. Debt_{t-1} + \varphi_4 Gov. Budget Def_{t-1} + \varphi_5 Cont. Corruption_{t-1} \\ & + \varphi_6 Pol. stability_{t-1} + \sum_{i=0}^p \vartheta_1 \Delta ln Inf_{t-1} + \sum_{i=0}^q \vartheta_2 \Delta ln Ex. Rate_{t-1} + \sum_{i=0}^r \vartheta_3 \Delta ln Ext. Debt_{t-1} \\ & + \sum_{i=0}^s \vartheta_4 \Delta Gov. Budget Def_{t-1} + \sum_{i=0}^t \vartheta_5 \Delta Cont. Corruption_{t-1} + \sum_{i=0}^u \vartheta_6 \Delta Pol. stability_{t-1} \\ & + v_t \end{aligned} \quad (4)$$

Where p,q,r,s,t and u represent the optimal number of lags according to the Akaike's Information Criterion (AIC);  $\Delta$  is the first difference operator. The long-run relationship is captured by  $\varphi_i$ 's and with  $i=1 \dots 6$  while  $\vartheta_i$ 's reflects the short-run dynamics of the models.

The ARDL bounds testing approach tests the null hypothesis of no cointegration which means that the coefficients of the long-run variables are equal to zero ( $H_0: \varphi_{1 \dots 6} = 0$ ), compared to an alternative hypothesis of the existence of linear cointegration among variables ( $H_0: \varphi_{1 \dots 6} \neq 0$ ). These hypotheses are tested based on the non-standard F-test proposed by Pesaran et al. (2001). In a situation where the computed F-statistic is larger than the upper critical value, the null hypothesis of no cointegration cannot be accepted, otherwise, the null hypothesis cannot be rejected. After confirming the existence of the cointegration i.e., existence of long-run relationship between the variables we estimated the ARDL error correction model as specified in the following equation:

$$\begin{aligned} \Delta IFF\_ \%GDP_t = & \sum_{i=0}^p \vartheta_1 \Delta ln Inf_{t-1} + \sum_{i=0}^q \vartheta_2 \Delta Ex. Rate_{t-1} + \sum_{i=0}^r \vartheta_3 \Delta ln Ext. Debt_{t-1} + \sum_{i=0}^s \vartheta_4 \Delta Gov. Budget Def_{t-1} \\ & + \sum_{i=0}^t \vartheta_5 \Delta Cont. Corruption_{t-1} + \sum_{i=0}^u \vartheta_6 \Delta Pol. stability_{t-1} + \theta ECT_{t-1} + v_t \end{aligned} \quad (5)$$

Where the term  $ECT_{t-1}$  is the error-correction term and  $\delta$  is the ECT coefficient, representing the speed of adjustment of the equilibrium level if there is a disturbance in the system.

### Granger causality approach

To facilitate an analysis of the direction of causality the Granger causality test is applied. In this analysis, several relationships are possible: univariate Granger causality moving from  $x_t$  to  $y_t$  or from  $y_t$  to  $x_t$ , bivariate causality moving in both directions and no causality effect. The Granger test in the study was performed on the natural resource's illicit financial outflows as percentage of GDP ( $IFF\_ \%GDP$ ) as expressed in the equation below:

$$IFF\_ \%GDP_t = \sum_{i=0}^r \eta_i IFF\_ \%GDP_{t-i} + \sum_{j=0}^s \phi_j \Delta X_{t-j} + \varepsilon_t \quad (6)$$

$$X_t = \sum_{j=0}^s \phi_j \Delta X_{t-j} + \sum_{i=0}^r \eta_i lnNR. IFF_{t-i} + v_t \quad (7)$$

Where: X represents any explanatory variables. X is tested against  $lnNR\_ IFF$  and vice-verse. r and s denote the number of lags to be included in the regression specification;  $\eta$  and  $\phi$  are unknown parameters to be estimated;  $\varepsilon_t$  and  $v_t$  are the independently and identically distributed error terms.

Given that Granger causality tests do not determine the strength of causality effects during a period of time (Rahman and Shahbaz, 2013), the study employs the Generalized Impulse Response Function (GIRF) developed by Koop et al. (1996) and suggested by Pesaran and Shin (1998) to capture these effects. Hacker et al. (2014) used Granger causality test and impulse response function to study the causality between spot exchange rate and interest rate differential. The authors found that the strength of causality increase with time.

Finally, to avoid spurious results due to the non-stationarity of the series, a unit root test was performed to check whether the series are stationary. If not, a difference-Stationary processes technique was applied to make the series stationary. In this regard, the stationarity properties of the variables are assessed using the Augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) tests.

## 5. Results and Discussion

### *Unit root test*

A unit root test for series stationarity was performed in the study. The study relied on the Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) t-statistic to determine series stationarity level. However, the latter was used as a robust test to the former, hence, results analysis is carried out for only the ADF test. The results are presented in Table 1, and it shows series to be stationary either at level or after first difference in both the ADF and PP unit root tests. From the results, NR-IFF and inflation were found to be stationary at level. This suggests that the series are integrated of order zero, I(0). However, Government Budget Deficit, Real Exchange Rate, External Debt, the Control of Corruption and Political Stability were found to be stationary only after first difference, thus, suggesting that the series are integrated at order one, I(1).

**Table 1 - Unit root Test.**

Variables	ADF-test		PP-test		Order of Integration (ADF-test)
	Level	1 <sup>st</sup> Diff.	Level	1 <sup>st</sup> Diff.	
IFF_%GDP	-4.234***		-4.320***		I(0)
Inflation	-4.356***		-2380	-3.144**	I(0)
Real Ex. Rate	-1.098	-4.739***	-0.667	-4.596***	I(1)
lnExt.Debt	-1.336	-2.926**	-2.725*		I(1)
Gov. Budget Deficit	-2.313	-4.953***	-3.318**		I(1)
Cont. Corruption	-0.997	-2.869*	-0.459	-2.898*	I(1)
Pol. Stability	-0.902	-2.925**	-0.731	-3.834***	I(1)

\*, \*\* and \*\*\* indicate significance at 1%, 5% and 10% levels, respectively  
Source: Authors' compilation using Eviews 10

### *Lag order selection for ARDL and Vector Autoregressive (VAR) models*

The granger causality test was performed after applying the VAR model. Hence, prior to testing for causality, the study determined the optimal lag length for the underlying VAR specification using five statistical tests, namely Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz Information Criterion (SBIC). The SC test selected a VAR specification with one lag, while the remaining statistical tests indicated that four lags are required as shown in Table 2. Therefore, based on the indication of most statistical tests, the VAR model was estimated based on four lags.

**Table 2:** Lag order selection on VAR model.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-465.292	NA	4.966	21.467	21.751	21.573
1	-141.238	530.270	1.90e-05	8.965	11.236	9.807
2	-85.099	74.002	1.63e-05	8.6408	12.898	10.219
3	-24.455	60.643	1.57e-05	8.111	14.356	10.427
4	180.056	139.439*	4.25e-08*	1.042*	9.274*	4.095*

Source: Authors' compilation using Eviews 10.

### The ARDL bound test for cointegration

The bounds test of cointegration results, of which are presented in Table 3, indicate a rejection of the null hypothesis as ARDL F-statistics are greater than the upper bound critical values at all 1%, 5% and 10% significance levels thus, indicating the existence of a long-run relationship among the variables.

**Table 3:** ARDL bounds test.

Statistic test	Value	Signif.	I(0)	I(1)
F-statistic	5.627	1%	2.88	3.99
K	6	5%	2.27	3.28
		10%	1.99	2.94

Source: Authors' compilation using Eviews 10.

### ARDL estimation Results

The ARDL estimation result responds to the study's first research question (Section 1) by analyzing the effect of macroeconomic factors on N\_IFF. The results are presented in Table 4 for both the long run and short run. However, the short run was estimated with a lag structure of (4, 3, 1, 3, 1, 1, 3). The Durbin Watson results reveal the absence of first-order residuals serial autocorrelation as its statistic value (2.05) is great than 5%. Similarly, the Breusch-Pagan-Godfrey results established that the null hypothesis of Homoscedasticity on the residuals was not rejected. Analysis for the ARDL estimation result proceeds as follows:

#### Long run

The result for the long run revealed that, among the macroeconomic variables, only real exchange rate and government budget deficit were found to be statistically significant. In contrast, inflation and external debt were found to be statistically insignificant in the long run. Similarly, for the control variables, the political stability was found to be statistically significant while control of corruption was found to be the opposite.

The long-run results also revealed that real exchange rate have a positive influence on illicit financial outflows from the natural resource sector. The result posits that a one percent increase in real exchange rate increase the natural resource sector illicit financial outflows shares on GDP by 0.015%, ceteris paribus. Unlike Signé et al. (2020), the finding is statistically significant. Thus, the result suggests that an appreciation of the currency motivates the illicit movement of financial flows in the natural resource sector in Mozambique. Intuitively, an appreciation of the real exchange rate implies a loss of trade competitiveness (Tarawalie & Jalloh, 2021) which apparently weakens the country's current account position hence, increasing the risk of financial flight (Pettinger, 2019).

In the long run, government budget deficit was found to have a positive effect on Mozambique's natural resource illicit financial flows. From the result, a one percent increase in government budget deficit leads to 0.41% increase in the movement of illicit financial flows from the natural resource sector in Mozambique, *ceteris paribus*. This implies that as the level of government budget deficit increases, the likelihood of illegal transfer of financial flows from the natural resource sector becomes higher. Generally, widening government budget deficit is a set off for illicit financial flows because it is a signal of an impending tax increase, especially when the government wants to raise funds to amortize its short-term debt. To this, economic agents might react through the expatriation of their funds. The result aligns with Lhlou and Mossadak (2013).

**Table 4:** Estimated ARDL for natural resources illicit financial outflows (%GDP).

Variable	Coefficient	Std.Error	P-Value
<b>Long-Run</b>			
LnInflation	0.046	0.027	0.106
lnReal Ex.Rate	0.015	0.002	0.000***
lnExt.Debt	0.002	0.018	0.887
Gov. Budget Deficit	0.408	0.115	0.002***
Control of Corruption	0.015	0.034	0.648
Political stability	-0.035	0.008	0.000***
<b>Short-Run (4, 3, 1, 3, 1, 1, 3)</b>			
D (IFF_%GDP (-1))	0.931	0.269	0.002***
D (IFF_%GDP (-2))	0.863	0.232	0.001***
D (IFF_%GDP (-3))	0.728	0.145	0.000***
D (lnInflation)	0.155	0.083	0.077*
D (lnInflation (-1))	-0.269	0.082	0.003***
D (lnInflation (-2))	-0.117	0.076	0.138
D (lnReal Ex.Rate)	-0.005	0.007	0.464
D (Gov. Budget Deficit)	0.007	0.037	0.851
D (Gov. Budget_Deficit (-1))	0.060	0.038	0.131
D (Gov. Budget_Deficit (-2))	0.140	0.037	0.001***
D (lnExt. Debt)	0.748	0.382	0.063*
D (Control of corruption)	0.434	0.092	0.000***
D (Political stability)	-0.030	0.017	0.094*
D (Political stability (-1))	0.025	0.018	0.176
D (Political stability (-2))	-0.043	0.017	0.020**
ECT (-1)	-0.934	0.089	0.000***
R-Square	0.904		
Adjusted R-squared	0.852		
Durbin Watson	2.046		
Breusch-Pagan-Godfrey	0.224		
Obs	44		

\*, \*\* and \*\*\* indicate significance at 10%, 5% and 1% levels, respectively  
Source: Authors' compilation using Eviews 10

Again, the long-run results showed political stability to reduce the movement of natural resources illicit financial flows from Mozambique. The result revealed that one point increase in the political stability index reduces natural resources illicit financial outflows by 3.5%, *ceteris paribus*. The result suggests that efforts to ameliorate the political environment could minimize the amount of illicit financial outflows. This is plausible because financial assets of people, let alone economic agents, are never secured in a

politically unstable environment since institutional apparatus would be largely dysfunctional. The finding is in line with Signé et al. (2020) and Orkoh et al. (2018).

### ***Short run***

The results from the short run revealed that the Error Correction Term (ECT) was found to be negative and statistically significant thus, reaffirming the position of a long run relationship in the study. From the result, it was observed that for any short run disequilibrium to the long run in the model is corrected at the 93% adjustment speed, quarterly. The results show that the past values of the shares of illicit financial outflows influence positively the actual values.

The result found that the first, second and third lag of the dependent variable were found to positively influence the movement of illicit financial flows from the natural resource sector. Interestingly, the likelihood becomes greater over time. All else remaining constant, a percentage increase in the first, second and third lag of the dependent variable leads to an increase in the movement of illicit financial flows from the natural resource sector by 0.93%, 0.86%, and 0.73% respectively. This is likely if the implementation of policies and mechanisms to minimize the illicit flows of finances are weak.

Contrary to the long run results, the effect of inflation was found to have a significantly positive effect on illicit financial outflows from the natural resource sector in the short run. The result revealed that a one percent increase in the level of inflation leads to a 0.15% increase in natural resource illicit financial outflows, *ceteris paribus*. The result suggests that as higher rates of inflation tend to increase the movement of illicit financial flows because it can erode the value of financial assets (Kar, 2012). The finding is in agreement with Letete and Sarr (2017). Nonetheless, the first lagged of inflation revealed an opposite effect, suggesting that the previous year's level of inflation tends to reduce illicit financial flows from the natural resource sector in Mozambique.

In line with the long-run, the results also revealed that a one percent increase in the second lag of government budget deficit increases natural resource sector illicit financial outflows by 0.14%, *ceteris paribus* in the short run. The result suggests that a government budget deficit of two years back could influence positively the movement of illicit financial flows from the natural resource sector in Mozambique. If government deficits are not controlled and remains persistent over time, incentives for the movement of illicit financial flows could be strong from economic agents because it would eventually lead to a deterioration of macroeconomic indicators and create economic uncertainty (Lhlou & Mossadak, 2013).

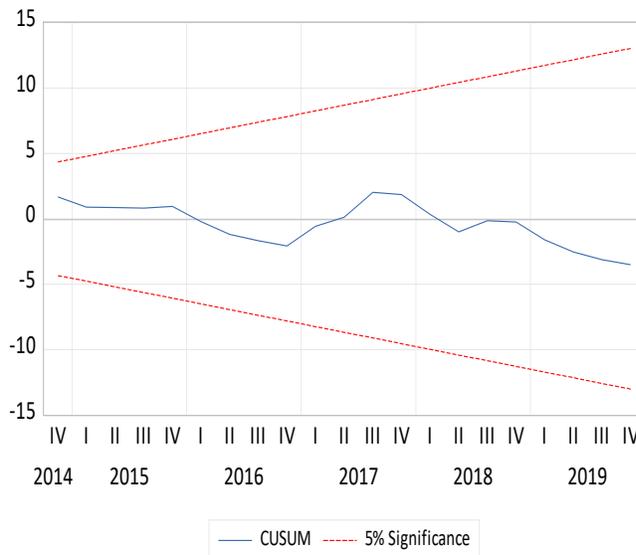
Similarly, all things being equal, a one percent increase in external debt was found to increase the shares of illicit financial outflows from the natural resource sector by 0.75%, in the short-run. The result suggests that increasing external debt is likely to result in the movement of illicit financial outflows. This is likely, especially when governments resort to higher taxes to generate enough funds to service their debt. This could discourage and affect existing businesses thereby, forcing them to respond through the transfer of capital licitly and illicitly. The finding supports Anetor (2019) and Tarawalie and Jalloh (2021).

The control of corruption was found to increase natural resources illicit financial outflows in the short run. The results showed that a unit increase in control of corruption index increases the movement of illicit financial flows from the natural resource sector by 43%, *ceteris paribus*. The result deviates from the general intuition which suggests that efforts to reform and make state institutions more robust and functional could minimize the amount of illicit financial outflows. In contrast, political stability and its second lag were found to reduce the movement of illicit financial flows from the natural resource sector in the short run. The finding conforms to the long-run result which implies that illicit financial flows are more likely to be passed over into safer jurisdictions in times of political instability.

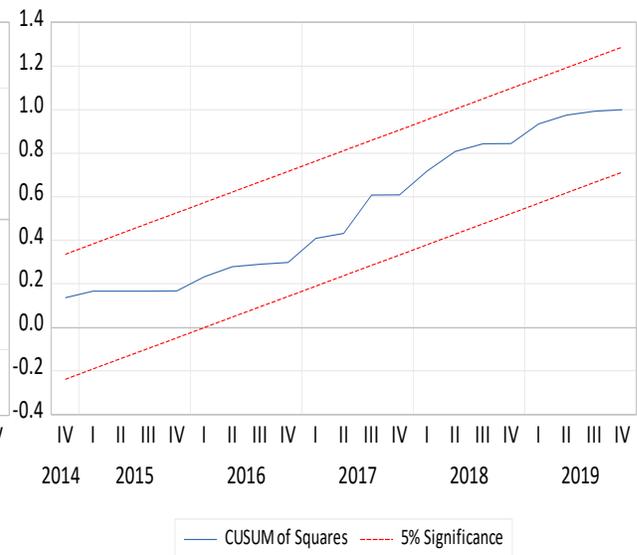
**Diagnostic Test**

The study further assessed the stability of the model using the cumulative sum residual stability test (CUSUM) and CUSUM of squares, Figure 1 and Figure 2, respectively. The study finds parameter stability given that the CUSUM and CUSUM of squares lie inside the area between the two 5% critical lines.

**Figure 1: ARDL CUSUM stability test.**



**Figure 2: ARDL CUSUM of Squares stability test.**



Source: Authors.

**Granger causality and impulse response results**

The results offer a response to the study’s final research question (see Section 1). As shown in Table 5, illicit financial outflows Granger causes inflation, and the inverse was not observed. Also, a unidirectional causality was observed moving from real exchange rate illicit financial outflows and from political stability to illicit financial outflows. Nevertheless, a bidirectional causality effect was observed. From the results, a bidirectional effect was found to exist between illicit financial outflows and external debt, similarly between control of corruption and illicit financial outflows.

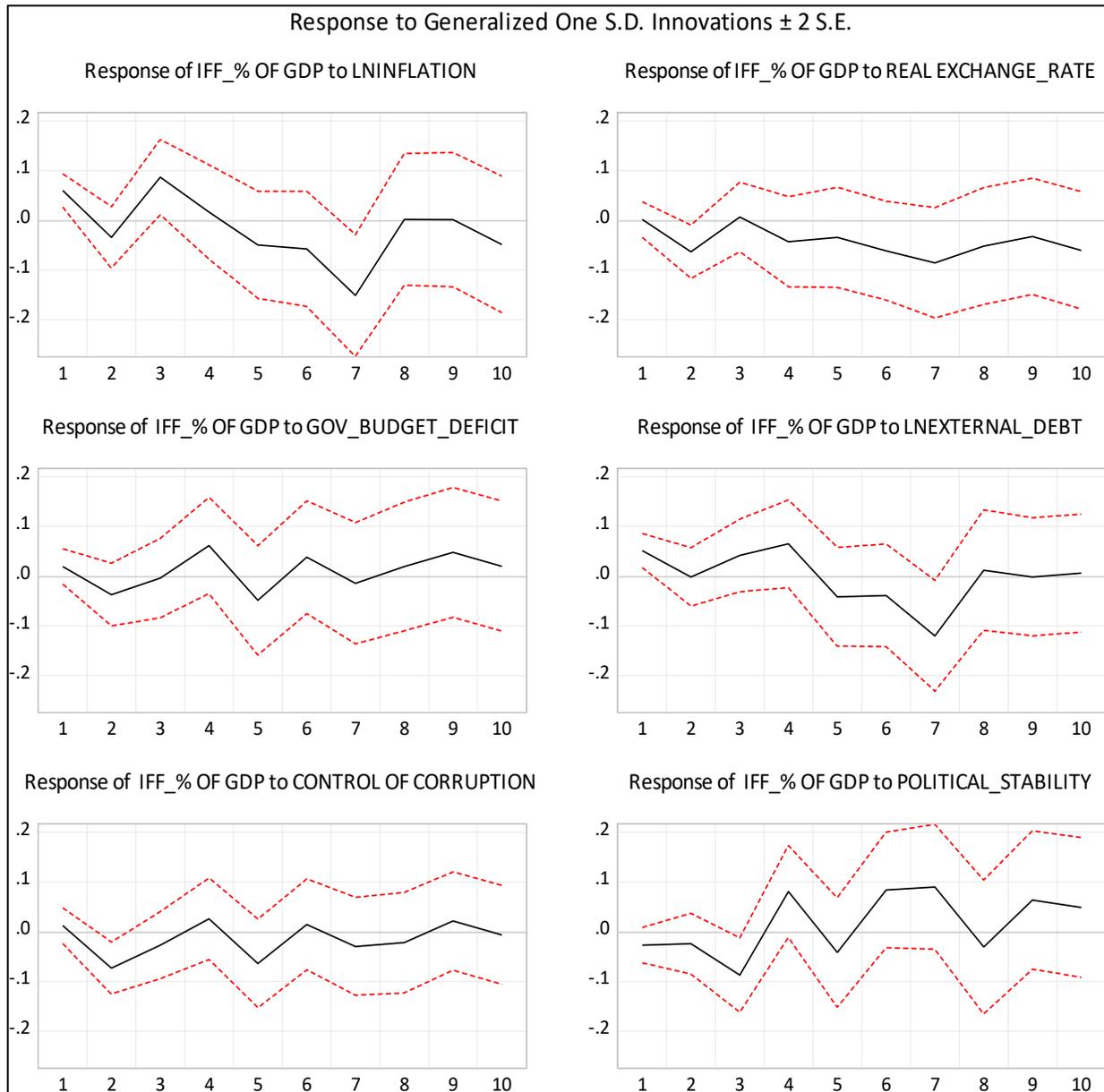
**Table 5:** VAR Granger causality test.

Null hypothesis	Obs	Lags	Chi-squared	P-value
lnInflation $\nRightarrow$ IFF_%GDP	44	4	4.090	0.393
IFF_%GDP $\nRightarrow$ lnInflation	44	4	11.646	0.020**
D(Real Ex.Rate) $\nRightarrow$ IFF_%GDP	43	4	18.509	0.001***
IFF_%GDP $\nRightarrow$ D(Real Ex.Rate)	43	4	4.577	0.333
D(lnExt.Debt) $\nRightarrow$ IFF_%GDP	43	4	20.369	0.000***
IFF_%GDP $\nRightarrow$ D(lnExt.Debt)	43	4	20.497	0.000***
D(Gov. Budget Deficit) $\nRightarrow$ IFF_%GDP	43	4	3.990	0.407
IFF_%GDP $\nRightarrow$ D(Gov. Budget Deficit)	44	4	2.349	0.671
D(Control of Corruption) $\nRightarrow$ IFF_%GDP	43	4	13.912	0.007***
IFF_%GDP $\nRightarrow$ D(Control of Corruption)	43	4	44.882	0.000***
D(Political Stability) $\nRightarrow$ IFF_%GDP	43	4	43.592	0.000***
IFF_%GDP $\nRightarrow$ D(Political Stability)	43	4	5.4180	0.247

*Note:*  $\nRightarrow$  means inexistence of granger causal effect moving from one variable to another  
*Source:* Authors' compilation using Eviews 10

The granger causality test in Table 5 show the direction of causality, however, it does not reveal the magnitude of a shock on a variable over time. In this sense was employed Generalized Impulse Response Functions (GIRFs). Figure 3 show how natural resource illicit financial outflows shares on GDP reacts over time to the exogenous variables' impulse. The results reveal that a one standard deviation increase in the inflation will cause natural resources illicit financial outflows to increase from second to third quarter where it will highly decrease until seventh quarter. The impulse of inflation will keep natural resource IFF\_%GDP stationary only between eighth and ninth quarter where it will start decreasing. The response of natural resource IFF\_%GDP to real exchange rate impulse will be mainly negative both short-run and long-run following a decreasing pattern. The impulse of external debt will cause a positive response of natural resource IFF\_%GDP from first to fourth quarter followed by highest negative response seventh quarter. A one standard deviation increase in government budget deficit will cause an asymmetric impact on natural resource IFF\_%GDP in short-run. In long-run this effect will be mainly positive. The effect of the control of corruption impulse on natural resource IFF\_%GDP will be will be predominantly negative in both short-run and long-run. From other side, the GIRFs results reveal that a chock caused by political stability will cause a highly unstable impact on natural resource IFF\_%GDP in short-run and long-run. From the IRF results in Figure 3 it is said that shocks on the exogenous variables will have an asymmetric impact on natural resource IFF\_%GDP in both short and long-run.

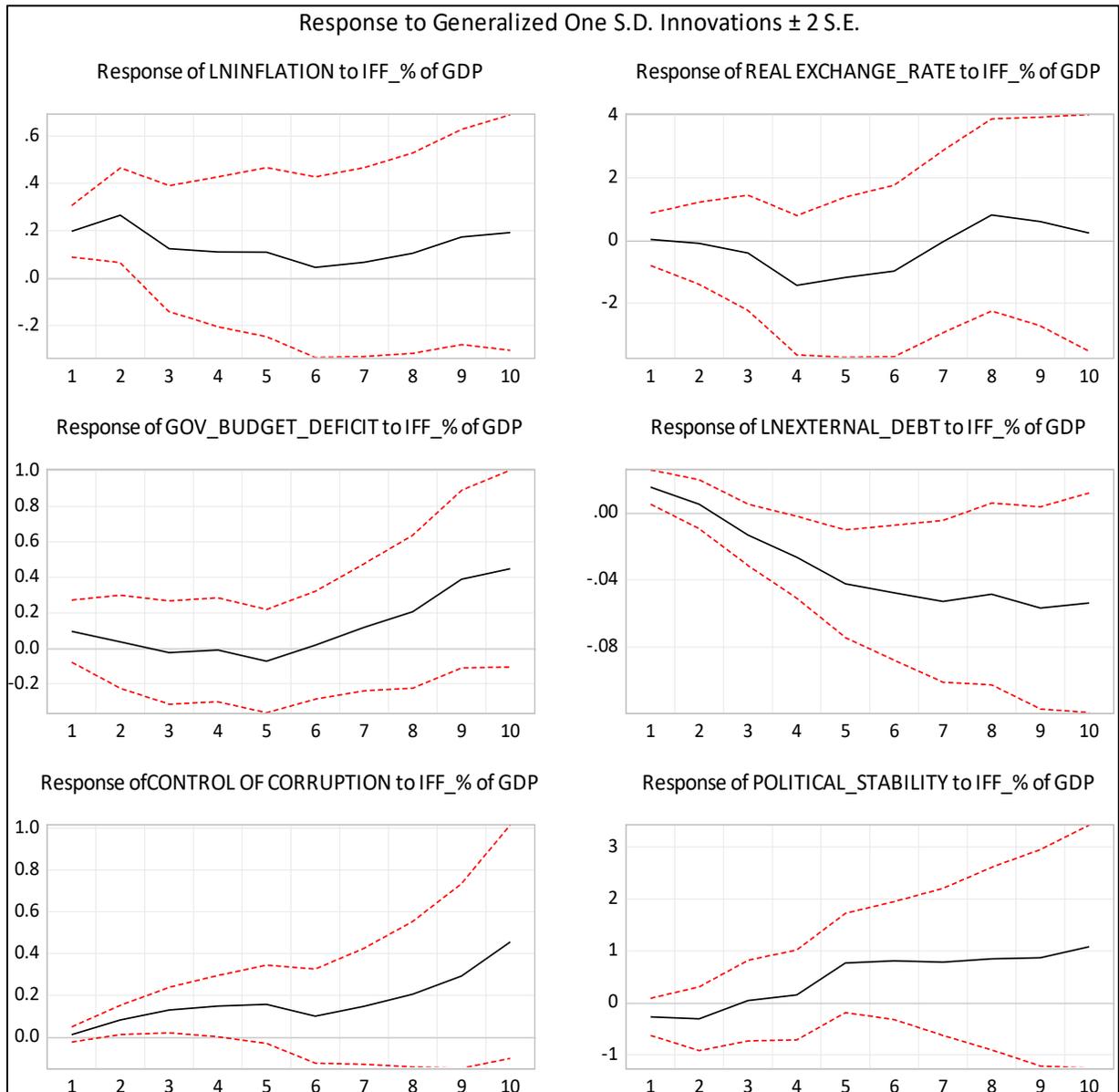
**Figure 3:** Response of natural resources IFF to exogeneous variables chocks.



Source: Authors.

The results in Figure 4 show how macroeconomic variables and control variables respond to natural resource IFF\_%GDP shocks. Compared to the exogenous variable's impulses (Figure 3), natural resource IFF\_%GDP impulse causes more defined responses. The results show that the response of inflation will be positive in short-run and long-run. Contrarily, the responses of real exchange rate will be negative in short-run. A one standard deviation of natural resource IFF\_%GDP will cause a sharp downward trend of the external debt in both periods. A opposite trend will be observed on the government budget deficit response to natural resource IFF\_%GDP. Similarly control of corruption and political stability indexes.

**Figure 4:** Response of exogenous variables to natural resources IFF checks



Source: Authors.

## 6. Conclusion and Policy Recommendations

The purpose of this study was to investigate the effect of macroeconomic factors on IFF from the natural resource sector in Mozambique, as well as, to examine whether any causality exists between IFF and the macroeconomic factors. For analysis, the study relied on quarterly time series data using an ARDL estimation procedure and the granger causality test. From the results, it was established that real exchange rate and government budget deficit were the only macroeconomic factor that exerts a significant effect on IFF from the natural resource sector in Mozambique in the long run. Furthermore, political stability was found to ameliorate the level of natural resource sector IFF from Mozambique. While the ECT was found to reinforce the existence of a long run relationship, the short-run results further reveal that the lagged values of the dependent variable, inflation and its first lag, the second lag of government budget deficit, external debt, control of corruption, and political stability and its first lag were found to have an effect

on natural resource sector IFF in Mozambique. Intuitively, the results suggest that inflation and external debt in the short-run and government budget deficit and exchange rate in the long-run would induce IFF from the natural resource sector in Mozambique. While the effect of the control of corruption on IFF deviates from general intuition, ensuring a politically stable country is crucial in reducing IFF from the natural resource sector in Mozambique. Meanwhile, while unilateral granger causality was observed, bidirectional effect was found to exist between illicit financial outflows and external debt, and between control of corruption and illicit financial outflows.

In line with the findings, the study recommends that the government of Mozambique pursue policies that would improve the macroeconomic position of the country for both the short-term and long-term. On the fiscal side, the GoM should ensure fiscal consolidation and embark on a prudent use and management of public resources, as well as, avoiding prolong and widening budget deficit. This is critical not only for investors' confidence but also the stability of other macroeconomic indicators like the interest rate in the long-run (Lhlou & Mossadak, 2013). Also, policies and mechanism regarding the real exchange rate must be designed with an intention of improving the country's trade competitiveness; while monetary policies should be geared towards controlling the level of inflation. Furthermore, the GoM should pursue, enhance and support efforts directed towards the consolidation of peace as it would not only generate a friendly political environment but also helps in curtailing IFF from the natural resource sector in Mozambique. And with the Islamic insurgency in Cabo Delgado and the armed attacks in some parts of the north zone, this is essential.

While the findings in the study are reliable and provide useful contribution to the literature, future studies can examine the effect of macroeconomic factors on IFF in Mozambique at the on a national level. Furthermore, future studies could explore the possibility of looking at IFF from other sectors. Through this, a comparative analysis can be conducted thus providing policy makers with more informed guidance on policy actions to tackle IFF.

## Declaration

The authors are both post-graduate students at the Eduardo Mondlane University and University of Ghana respectively. The views expressed in this paper are those of the authors and do not in any way represent the official position of the Eduardo Mondlane University and University of Ghana.

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