# Asymmetric Pass-through of Taxation and Deficit Financing to Inflation: Evidence from the West African Monetary Zone (WAMZ)

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#### Abstract

In this study, we deepen the understanding of the asymmetric effects of tax revenue, deficit financing, and debt servicing on inflation in the member countries (Ghana, Guinea, The Gambia, Liberia, Nigeria, and Sierra Leone) of the West African Monetary Zone (WAMZ). We employ a non-linear autoregressive distributed lag model (NARDL) and the Toda-Yamamoto causality test to analyze the datasets obtained from the Organization of Economic Cooperation and Development (OECD) Statistics and World Development Indicators (WDI). The findings indicate that the inflation rate responds negatively to positive changes in tax revenue. This implies that an increase in taxation reduces the rate of inflation in the long run. The partial sums of positive and negative changes in external debt stock have mixed effects on the inflation rate over the long term. While the inflation rate responds positively to positive changes in external borrowings, its response to negative changes in external borrowings is significantly negative at the 5% level. The positive effect of external borrowings on the inflation rate demonstrates that funds borrowed from external sources increase the money supply, which stimulates inflationary pressures in the region. Further analysis revealed that the asymmetric long-term effect of external debt servicing on the inflation rate is positive. This indicates that an increase in debt servicing is inflationary in the long run. Given the findings, we recommend that the fiscal authorities in the WAMZ, especially the Ministry of Finance, Debt Management Agencies, and the West African Monetary Institute (WAMI), ensure that loans from external sources to member countries are directed towards fostering higher long-term growth to maintain price level stability.

**Keywords:** Inflation, deficit financing, taxation, external borrowings, debt servicing and WAMZ

#### **1. Introduction**

The member countries (Ghana, Guinea, the Gambia, Liberia, Nigeria, and Sierra Leone) of the West African Monetary Zone (WAMZ)\_have persistently pursued tax reforms to increase revenue and output and frame the narrative in tax mobilisation and management for improved economic and social development. Although the efforts of the member countries to achieve macroeconomic stability have been unrelenting, they seem to lack financial resources for long-term macroeconomic management, they do not seem to have fiscal resources for macroeconomic management in the long term. Consequently, there is a mismatch between the potential of the economies and the avenues to streamline them. Okpe (2000) contends that taxation provides a channel for transferring resources and income from households and firms to the government for economic and social development. However, Ebeke & Ehrhart (2012) describe tax revenues in Africa as generally volatile due to chronic economic and political instability. Thus, it becomes difficult to forecast future tax revenues, which constrains the development of medium-term financial plans for improved macroeconomic goals. The

administration of the tax system in the WAMZ is not efficient because it has a weak institutional framework. Institutions responsible for policy formulation, effective administration, transparency, and accountability of the tax system are largely adjudged as ineffective and inefficient.

Many developing economies, including Africa complement taxation with deficit financing to meet their rising fiscal needs. Deficit financing, from the Keynesian perspective, is a means of creating employment, raising output, and boosting aggregate demand. Arestis & Sawyer (2004) posit that deficit financing is a substitute source of finance that accelerates economic activity by boosting aggregate demand. It helps governments to manage fiscal strains, which pose quite seriously the attainment of macroeconomic targets. Aside from arguments in favour of deficit financing, such as Koatsa, Paramaiah & Scona (2021) and Eregha & Mesagan (2020), there were counter-arguments regarding the drawbacks of deficit financing. Amgain & Dhakal (2017) argue that deficit financing is incurring debt which future generations will have to live with due to anticipated increased tax levels which undermine growth benefits of tax revenues in the long run.

As outlined in the theory of money, Friedman (1971) described how deficit financing triggers money supply growth, which increases inflation with a detrimental impact on economic growth. The increasing fiscal dominance in the WAMZ has increased the need for deficit financing, with the debt-to-GDP rising above the economically sustainable threshold in the Zone. The funding of such deficit has been highly difficult with inflationary pressures above the intended and desired single-digit inflation level. The changing dimensions of tax revenues and deficit financing have continued to raise concerns about the perceived macroeconomic implications in the WAMZ. Given the unending controversies, this study examines the asymmetric effect of tax revenues and deficit financing on price stability in the WAMZ. Following the introduction, the rest of the research is structured in the following way: Section II is related literature, and Section III focuses on the methodology and data issues. In Section IV, we provide and discuss the findings, while Section V embodies the conclusion and policy insights.

## 2. Related Literature

The fiscal theory of the price level (TFPL) proposed by Sargent & Wallace (1973) posits that the price level is determined by fiscal policy and not by monetary policy. Specifically, this suggests that the real value of public debt, which is dependent on government expenditure and taxation policies, determines the price level. Contrary to the orthodox monetarist position, where money supply is the key determinant of inflation. The TFPL places utmost significance on fiscal policy and its impact on the price level, as outlined in the original paper of Sargent & Wallace (1973). It is known from this theory that a government with an enormous, long-run budget deficit may indulge in "seigniorage" by creating money to finance its spending. This creation of money without any increase in the real production of goods and services will have an inflationary impact. Advocates (Cochrane, 2019; Woodford, 1994; Sims, 1994) of FTPL argue that the price level is uniquely determined, even when interest rates remain unchanged. Their argument is based on a reinterpretation of the government's debt accumulation equation, which is seen not as a budget constraint but as an equation of debt valuation.

Bassetto (2008) and Carlstrom & Fuerst (2000) challenged the conventional monetary theory of inflation as they explained that inflation can be driven by fiscal policy initiatives such as government debt, spending, and taxes. However, the FTPL has been criticised over time. According to the critics (Buiter, 2017; McCallum, 2003), FTPL tends to suffer from the dynamic inconsistency issue. This means that what seems to be the best fiscal policy today might not be seen as credible tomorrow. If the government is perceived to likely default on its debts, the FTPL can predict inflationary effects that do not happen in real life. The theory has

also faced criticism for overly simplistic assumptions about market operations and how agents develop their expectations and its limited empirical evidence backing these assumptions, as much of the historical data tends to align more closely with traditional monetary theories regarding price level determination.

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Furthermore, numerous previous studies have explored the contributions of taxation and deficit financing to inflation pressures, and the findings varied across countries and regions. The findings by Adediji& Adesanya (2023), Urquhart (2022); Prabheesh *et al.* (2024); Maitra & Hossain (2024), Jemutai, Mwito & Joshua (2024), Serin & Demir (2024), and Sumba (2023) showed that deficit financing is inflationary. These studies authenticate the FTPL, indicating that higher fiscal deficits produce inflationary pressures. However, this is contrary to the findings of Nneka, Toro & Ezenna (2023), who found that deficit financing through an increase in borrowing from outside deposit money banks is associated with a decline in inflation. In addition, Adegbite (2019); Oyeleke & Onatunji (2024); Buzugbe & Ohwofasa (2024) showed that an increase in taxation mitigates inflationary pressures. This deviated from the findings of Onyele, Umezurike & Nwagwu (2024), who established that taxation stimulates inflation.



# 2.1 Stylized Facts on Inflation Trajectory in the Member Countries of WAMZ

Figure 2.1: Trends of inflation rate (%) in the WAMZ member countries (2005-2020) Source: Researchers' (2025) computation based on data from OECD Statistics and World Bank WDI

The trends in inflation rates across the six countries revealed that double-digit inflation persisted in the majority of periods in most of these countries. This indicates that inflationary

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pressures have remained dominant in the WAMZ countries. More pronounced inflationary pressures are evident in Guinea, Nigeria, and Ghana. However, The Gambia experienced single-digit inflation during the study period, suggesting that the country has maintained a commendable level of price stability. Overall, the trend in inflation rates indicates that price instability remains a significant issue in the WAMZ.

#### 3. Data and Methodology

#### 3.1 Variable Description and Measurement

The inflation rate is measured by the change in prices over time and is usually expressed through a price index. Essentially, it highlights when prices are rising. For this study, we focused on the consumer price index, which examines the annual percentage change in consumer prices compared to the previous year, providing better insight into the inflation rate. The external debt stock as a percentage of gross national income (GNI) was employed to measure deficit financing. Due to increasing fiscal deficits, developing economies, including those in the WAMZ, are likely to rely on foreign borrowing to meet their fiscal obligations, and an increase in external borrowing is expected to stimulate inflationary pressures following the proposition of the fiscal theory of price level. Furthermore, taxation is represented by the ratio of tax revenue to GDP in the WAMZ. An increase in tax revenue is likely to reduce inflation due to a decline in the purchasing ability of households and businesses. However, by increasing government revenue, an increase in taxation may be inflationary. The servicing of debt is measured by the total debt service as a percentage of GNI. When debt servicing costs are high, they can put a real strain on investment and economic growth, which might eventually result in higher inflation. Data used for this analysis were obtained from the World Bank's World Development Indicators (WDI) and International Debt Statistics.

#### **3.2 Model Specification**

We followed the works of Adediji& Adesanya (2023) and Oyeleke & Onatunji (2024) with some modifications following the integration of tax revenues and external debt stock alongside external debt servicing. The functional specification of the model is provided as:

INFR = f(TXR, EXB, DSV)

Where: INFR = Inflation rate used as a measure of price stability, TXR = Tax revenue, EXB = External borrowing and DSV = Debt servicing

(1)

The panel non-linear autoregressive distributed lag (NARDL) model is specified as:

$$INFR_{t} = \lambda_{0} + \lambda_{1}INFR_{t-1} + \theta_{1}^{+}TXR_{t-1}^{+} + \theta_{2}^{-}TXR_{t-1}^{-} + \theta_{1}^{+}EXB_{t-1}^{+} + \theta_{2}^{-}EXB_{t-1}^{-} + \theta_{1}^{+}DSV_{t-1}^{+} + \theta_{2}^{-}DSV_{t-1}^{-} + \sum_{j=1}^{p}\beta_{1}\Delta INFR_{t-j} + \sum_{j=1}^{q} \left(\Omega_{1}^{+}\Delta TXR_{t-j}^{+} + \Omega_{1}^{-}\Delta TXR_{t-j}^{-}\right) + \sum_{j=1}^{q} \left(\Omega_{1}^{+}\Delta EXB_{t-j}^{+} + \Omega_{2}^{-}\Delta EXB_{t-j}^{-}\right) + \sum_{j=1}^{q} \left(\Omega_{1}^{+}\Delta DSV_{t-i}^{+} + \Omega_{2}^{-}\Delta DSV_{t-i}^{-}\right) + e_{1t}$$
(2)

Where: TXR<sup>+</sup> and TXR<sup>-</sup> = partial sums of positive and negative changes in tax revenues, EXB<sup>+</sup> and EXB<sup>-</sup> = partial sums of positive and negative changes in external borrowings, DSV<sup>+</sup> and DSV<sup>-</sup> = partial sums of positive and negative changes in debt servicing,  $\theta_1^+$  and  $\theta_2^-$ = Long run multipliers of the partial sums of positive and negative changes in the explanatory variables,  $\Omega_1^+$  and  $\Omega_2^-$  = short run parameters, P and q = maximum lag orders for the dependent and independent variables,  $\Delta$  = First difference operator and  $e_{1t}$  = error term

#### **3.3 Data Analysis Techniques**

We used the NARDL method developed by Shin, Yu, and Greenwood-Nimmo in 2014 to explore how tax revenue and deficit financing impact economic growth. This approach builds

on the standard ARDL model introduced by Pesaran, Shin, & Smith (2001), as it effectively captures the asymmetries in the explanatory variables by breaking down their positive and negative changes. For NARDL to be true, all the variables under investigation must be integrated to an order less than two. Descriptive statistics are also employed so that we can have a better picture of how each variable was distributed throughout the investigation and across the countries of the WAMZ. We also examined the causality direction between the variables with the modified Wald test, owing to Tado & Yamamoto (1995) and checked for unit root with the Im, Pesaran & Shin (IPS, 2003) panel unit root test. The model set up for the Tado & Yamamoto (1995) causality test is provided as follows:

 $INFR_{t} = k_{1} + \sum_{i=1}^{m} \phi_{1} INFR_{t-i} + \sum_{i=1}^{m} \phi_{1} TXR_{1t-i} + \sum_{i=1}^{m} \phi_{2} EXB_{3t-i} +$  $\sum_{i=1}^{m} \phi_4 DSV_{kt-i} + u_{1t}$  $TXR_{t} = k_{1} + \sum_{i=1}^{m} \phi_{1} INFR_{t-i} + \sum_{i=1}^{m} \phi_{1} TXR_{1t-i} + \sum_{i=1}^{m} \phi_{2} EXB_{3t-i} +$  $\sum_{i=1}^{m} \phi_4 DSV_{kt-i} + u_{2t}$  $EXB_{t} = k_{1} + \sum_{i=1}^{m} \phi_{1} INFR_{t-i} + \sum_{i=1}^{m} \phi_{1} TXR_{1t-i} + \sum_{i=1}^{m} \phi_{2} EXB_{3t-i} + \sum_{i=1}^{m} \phi_{2} EXB_{3t-i} + \sum_{i=1}^{m} \phi_{1} TXR_{1t-i} + \sum_{i=1}^{m} \phi_{2} EXB_{3t-i} + \sum_{i=1}^{m} \phi_{1} TXR_{1t-i} + \sum_{i=1}^{m} \phi_{2} EXB_{3t-i} + \sum_{i=1}^{m} \phi_{1} TXR_{1t-i} + \sum_{i=1}^{m} \phi_{2} EXB_{3t-i} + \sum_{i=1}^{m}$  $\sum_{i=1}^{m} \phi_4 DSV_{kt-i} + u_{3t}$  $DSV_t = k_1 + \sum_{i=1}^{m} \phi_1 INFR_{t-i} + \sum_{i=1}^{m} \phi_1 TXR_{1t-i} + \sum_{i=1}^{m} \phi_2 EXB_{3t-i} + \sum_{i=1}^{m} \phi_2 EXB_{3t-i}$  $\sum_{i=1}^{m} \phi_4 DSV_{kt-i} + u_{4t}$ (6)Where: K<sub>i</sub> denotes an (n x 1) vector of intercepts  $\phi_1 - \phi_4 = an (n \ge n)$  coefficient matrices

 $u_{1t} - u_{4t} = an (n \ge 1)$  vector of disturbance terms

The null hypothesis of no causal relationship for each of the equations was tested at a 5% level of significance using asymptotic chi-square distributed statistic and its associated probability value.

Table 1: Descriptive statistics of the variables					
Variable	Obs	Mean	Std. Dev.	Min	Max
INFR	96	10.850	5.668	0.407	34.69
TXR	96	9.909	2.593	4.38	17.7
EXB	96	48.365	73.057	4.950	497.93
DSV	96	2.700	7.957	0.102	59.67

# 4. Results and Discussion

#### Table 1. Descriptions of disting of the second black

## Source: E-views Output (2025)

As evident from the basic descriptive statistics, the average inflation rate stood at 10.85% during the study period. This is an indication that the price instability has continued to persist in the WAMZ in the last one and half decade. In addition, tax revenue measured as a proportion of GDP varied from a low value of 2.59% to a high value of 17.7%. It, however, weighed an average of 9.91% of the GDP, which suggests that, on average, tax revenue accounts for less than 10% of the GDP in the WAMZ. This implies that the countries in the WAMZ were not able to mobilize an adequate amount of revenue from the tax base. The external debt stock and debt servicing averaged 48.365 and 2.700% of the GNI. The standard deviations showed that the observations for the inflation rate and tax revenue were clustered around their respective mean values. This is because the respective standard deviations for each of the variables are greater than their respective mean values. However, external debt stock and total debt servicing are associated with high standard deviations, which show that their observations do not cluster around their respective mean values.

Table 2: Summary of IPS panel unit test results					
Variable	Levels test results	First difference test results	Order of Integration		
	<b>IPS statistic</b>	<b>IPS statistic</b>			
INFR	-2.432***	NA	I(0)		
	(0.0001)				
TXR	-1.849**	NA	I(0)		
	(0.032)				
EXB	-11.778***	NA	I(0)		
	(0.000)				
DSV	-1.798	-5.235***	I(1)		
	(0.761)	(0.000)			

Source: STATA Output (2025)

Note: Figures in parenthesis are the corresponding probability values associated with of the IPS statistics, and NA denotes not available due to the evidence of stationarity at the levels

The IPS unit root test result presented in Table 2 indicated that inflation rate, taxation and external debt stock are all stationary at the levels given that their corresponding IPS statistics have probability values less than 0.05. This indicates that the null hypothesis of the unit root for these variables is rejected at 5%. That is, the variables (tax revenue and inflation rate and external debt stock) are integrated of order zero [I(0)]. However, total debt servicing is non-stationary at levels as represented in the IPS statistics probability values that exceed 0.05 at levels test results. Following its non-stationarity at levels, total debt servicing was differenced once, and it was found to be stationary at first difference. Therefore, the total debt servicing is integrated of order one [I(1)]. This implies that the outcomes of the IPS unit root test, the variables are mixed integrated [I(0) and I(1)]. The evidence of the mixed integration of the asymmetric relationship between the dependent variables and underlying explanatory variables.

Series: INFR TXR EXB DSV					
Sample: 2005 2020					
Null Hypothesis:	No cointeg	gration			
Alternative hypot	hesis: com	mon AR coefs.	(within-dimensi	on)	
		<u>Statistic</u>	Prob.	Weighted Statistic	Prob.
Panel v-Statistic		-1.797652	0.9639	-1.857515	0.9684
Panel rho-Statistic		0.574126	0.7171	1.151107	0.8752
Panel PP-Statistic		-3.249654	0.0006	-1.756124	0.0395
Panel ADF-Statistic		-5.231241	0.0000	-4.071420	0.0000
Alternative hypothesis: individual AR coefs. (between-dimension)					
		<b>Statistic</b>	Prob.		
Group rho-Statistic		1.358564	0.9129		
Group PP-Statistic		-2.948854	0.0016		
Group ADF-Statistic -5.		-5.113420	0.0000		
Sources Descendence's computation (2021) using E views 10					

 Table 3: Pedroni residual cointegration test results

Source: Researcher's computation (2021) using E-views 10

As observed from Table 3, six outcomes are significant at 5 per cent level given that their probability values are less than 0.05. This finding necessitates the rejection of the null hypothesis of no cointegration. It, therefore, follows from the results that long run relationship exists between inflation rate, tax revenue, external debt stock and external debt servicing. The evidence of cointegration among the variables aligns with the findings of Prowd (2020) and Nwakobi, Echekoba & Ananwude (2018). Given this finding, there is enough empirical evidence to estimate the NARDL model to deepen the understanding the asymmetric effects of tax revenue, deficit finance and external debt servicing on price stability in the WAMZ countries.

Dependent Variable: D(INFR)				
Method: ARDL				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long run equat	tion		
TXR_POS	-0.594435	0.061399	-9.681520	0.0000
TXR_NEG	-0.146727	0.133288	-1.100824	0.2783
EXB_POS	0.253634	0.031953	7.937670	0.0000
EXB_NEG	-0.086153	0.010968	-7.854920	0.0000
DSV_POS	0.829839	0.229994	3.608090	0.0009
DSV_NEG	0.348959	0.079136	4.409607	0.0001
	Short run equation			
COINTEQ01	-0.866789	0.221934	-3.905610	0.0004
D(TXR_POS)	0.435838	0.463339	0.940646	0.3532
D(TXR_NEG)	0.435704	0.386697	1.126733	0.2673
D(EXB_POS)	-0.109220	0.603055	-0.181112	0.8573
D(EXB_NEG)	-0.580850	0.343264	-1.692139	0.0993
D(DSV_POS)	0.125952	2.253339	0.055896	0.9557
D(DSV_NEG)	-1.235559	1.320628	-0.935584	0.3557
С	-8.716714	12.45289	-0.699975	0.4884

Table 4:	Asymmetric	long and	short run	results
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Source: Researcher's computation (2021) using E-views 10

The asymmetric results revealed that tax revenue has a significant negative impact on inflation. This suggests that an increase in taxation makes a meaningful contribution to price stability in the WAMZ. The negative impact of tax revenue on inflation differs from the results of Madni (2014) and Abdul-Qadir (2012), which suggest that an increase in taxes leads to an increase in inflation. In addition, external debt has mixed effects on the inflation rate in the long run. While the inflation rate responds positively to positive changes in external borrowings, it responds negatively to negative changes in external borrowings. The positive effect of external debt on inflation is in accordance with the fiscal theory of price level and the findings of Egbulonu & Wobilor (2016); Ezeabasilli, Mojekwu & Herbert (2012) and Mweni et al. (2012) that government debt stock is positively linked to inflation. On the other hand, the negative impact of external debt on inflation is consistent with the findings of Nkalu (2015). The positive contribution of external debt to inflation implies that deficit financing in the WAMZ is inflationary. In other words, deficit financing undermines the intended and desired goal of price stability given that it increases the growth of monetary aggregates and in so doing, generates inflationary pressures in the economy. However, total debt servicing contributed positively to inflation in the long run. This finding supports the previous studies by Oyeleke (2021), which affirm that debt servicing is inflationary. The error correction coefficient (-0.8667) is negative and highly significant at 1%, which indicates that distortions from the long run equilibrium position is corrected at a speed of 86.67% each year.

Tuble et Tour Tullulloto eurouity test tesuite					
Null Hypothesis (H <sub>0</sub> ): No causality relationship between the variables					
Series: INFR TXR EXB DSV					
Direction of causality	Chi-square (X <sup>2</sup> ) Statistic	P-value	Decision		
$INFR \rightarrow TXR$	3.786**	0.0517	Reject H <sub>0</sub>		
$TXR \rightarrow INFR$	14.02***	0.0002	Reject H <sub>0</sub>		
$INFR \rightarrow EXB$	0.517	0.4721	Accept H <sub>0</sub>		
$EXB \rightarrow INFR$	0.821	0.3650	Accept H <sub>0</sub>		
$INFR \rightarrow DSV$	1.4203	0.2333	Accept H <sub>0</sub>		
$DSV \rightarrow INFR$	0.537	0.4636	Accept H <sub>0</sub>		
TXR, EXB and $DSV \rightarrow INFR$	16.493***	0.0009	Reject H <sub>0</sub>		

Source: Researcher's computation (2021) using E-views 10

Note:  $\rightarrow$  shows direction of causality

As observed from the results in Table 5, there is bidirectional causality between tax revenue and the inflation rate during the study period. This finding implies that the variables are important in forecasting changes in each other. Thus, the null hypothesis of no causality is rejected in both instances. The results further revealed that there is no evidence of a causal relationship between external borrowing and inflation rate as well as between total debt servicing and inflation rate. However, no causality exists between monetary autonomy and the unemployment rate. In this case, the null hypothesis cannot be rejected. The result equally showed that there is joint causality from all the regressors to the inflation rate. This is a corroboration of the long-run relationship among the variables. Again, it affirms that tax revenue, external borrowings and total debt servicing can be relied upon in forecasting changes in the rate of inflation in Nigeria.

## 5. Conclusion and Policy Recommendations

The thrust of this study is to examine how tax revenue and deficit financing contribute to price stability in the WAMZ, as measured by the consumer price index (inflation). The findings indicate that deficit financing, particularly external debt and debt servicing, is inflationary. This emphasises that the growth of external borrowing and debt servicing undermines the macroeconomic goal of price stability in the WAMZ. Additionally, tax revenue is linked negatively to inflation, indicating its importance as a source of price stability in the WAMZ. Given these findings, the study concludes that external borrowings and debt servicing contribute to inflationary pressures in the WAMZ. Therefore, we recommend that the fiscal authorities in the WAMZ, especially the Ministry of Finance, Debt Management Agencies, and the West African Monetary Institute (WAMI), ensure that loans from external sources to member countries are directed towards fostering higher long-term growth to maintain price level stability. Governments across all WAMZ countries should implement sound debt management measures capable of providing a roadmap for cost-effective debt servicing and mitigating the undesirable impacts on price stability.

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