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Optimal inflation-growth threshold: A case of the ECOWAS members states

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Optimal Inflation-Growth Threshold: A Case of the ECOWAS Members States¹

WAMI OCCASSIONAL PAPER SERIES (OPS) NO. 34

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Abstract

This study provides country-specific empirical evidence on the optimal inflation-growth threshold in the ECOWAS (WAEMU and WAMZ) region from 1996-2022. Although there is large empirical literature on this subject, however, previous studies generally focused on exogenous approaches of determining optimal inflation which impose a sharp and most often linear behaviour on the threshold level of inflation. This paper contributes to the policy debate on the inflation-growth nexus by endogenously determining the individual country inflation threshold for fourteen (14) ECOWAS countries. The results from the study indicate that most of the countries have inflation in the lower regime to be positive while the high inflation regime is strongly negative, suggesting adverse effects of high inflation on growth. This finding is consistent with the theoretical proposition. It also shows varied threshold inflation across the region of ECOWAS, with optimal inflation rates for WAEMU - Benin (1.33%), Burkina Faso (2.00%), Cote-D'Ivoire (3.64%), Guinea-Bissau (3.68%), Mali (3.49%), Niger (3.17%), Senegal (1.66%) and Togo (3.89%), having inflation-growth threshold hovering around 1 to 4 percent. This is quite different to that of the WAMZ countries where The Gambia (4.93%), Ghana (10.44%), Guinea (9.21%), Liberia (8.72%), Nigeria (10.50%) and Sierra Leone (6.96%), are having a relatively higher inflation threshold, hovering around 5 to 11 percent. These findings suggest a potential difference in inflation tolerance levels in the ECOWAS (WAEMU and WAMZ) region. It is remarkable to note that the current ECOWAS Convergence criteria where the same level of lower single digit of inflation (5 percent) is being applied across all ECOWAS regions may not be growth enhancing for all the member states, particularly the WAMZ, where there appear to be more inflationary tolerance level and capacity to absolve relatively higher level of inflation. Therefore, there may be need to revisit this issue and consider a possibility of having a "range" inflation convergence criterion rather than "point. Lastly, Central Banks are encouraged to continue to pursue appropriate monetary policy measures to lower inflation to the desirable single-digit level.

Key Words: Inflation; Growth; Threshold Effects; Smooth Transition Regression; ECOWAS

JEL Classification : E31, O47, C22.

1.0 Introduction

The relationship between inflation and economic growth has been a subject of debate for decades. Some economists argue that inflation is beneficial for growth, while others contend that it is detrimental. However, the empirical evidence on this issue is inconclusive and varies across countries and time periods. One possible explanation for this ambiguity is that the inflation-growth nexus is nonlinear and depends on the level of inflation. In other words, there may be a threshold effect, such that inflation has a positive (or negative) impact on growth only up to (or beyond) a certain point, and then the effect reverses. Thus, understanding the relationship between inflation and economic growth is crucial in macroeconomic policy making as low and stable inflation is a key macroeconomic policy goal. This is one of the reasons why inflation is one of the convergence criteria for the ECOWAS monetary integration agenda.

Over the years, several studies have attempted to investigate this relationship for individual ECOWAS countries and some group of ECOWAS countries such as the WAMZ countries. For example, the West African Monetary Institute (WAMI) has undertaken five (5) related empirical studies to analyse different aspect of inflation-growth nexus in the WAMZ (WAMI, 2012; 2020; 2021; 2022, 2023). In WAMI (2012), an effort was made to analysed country-specific threshold levels of inflation in the WAMZ by applying conditional least square technique to annual time series data spanning 1970-2010 for Ghana, Nigeria and Sierra Leone, and 1980-2010 for the Gambia and Guinea. The conclusion was that a statistically significant relationship exists between inflation and economic growth with a threshold level of 9 percent.

In WAMI (2020) the authors investigated the relationship between inflation and relative price variability (RPV) using panel data. The aim was to determine the threshold level of inflation in the ECOWAS region and to investigate whether RPV react differently to different inflation regimes across the ECOWAS region with the aid of Panel Smooth Transition Regression (PSTR) model over the period 2008 to 2019. The conclusion was that ECOWAS countries can achieve RPV in the moderate inflation regime where the undesirable effect of expected inflation on RPV fades out. The paper also finds that inflation targets below the 5.5 percent and 8.3 percent per annum thresholds are desirable in the WAEMU and WAMZ respectively. In WAMI (2021) nonlinearities and country-heterogeneity in the inflation-growth nexus was investigated using PSTR model over the period 2001 to 2019. The results concluded that inflation threshold level of 10.3 percent per annum is beneficial for growth in the WAMZ region.

In WAMI (2022) the authors examined the fiscal policy channel of inflation, specifically the role played by government expenditure channel, in transmitting inflation shocks to economic growth within the WAMZ region. The study provided strong evidence that identifies the existence of government spending threshold, indicating that countries with government consumption expenditure to GDP ratio greater than the 7.7 percent threshold would be more prone to high inflation than their counterparts with low level of government

expenditures in the WAMZ. The findings highlight the relevance of discretionary fiscal policy in magnifying inflation through excess demand.

In WAMI (2023) the authors examined country-specific empirical evidence on the optimal inflation-growth threshold in the WAMZ for the period spanning 1996-2021 using Smooth Transition Regression model. Their results indicates that the optimal inflation rates for Ghana, Guinea, Liberia, Nigeria and Sierra Leone are 10.2, 10.8, 8.7, 10.8, and 7.4 percent respectively, at 5 percent significant level, whilst The Gambia's result was inconclusive. In addition, inflation effect on growth was positive in the lower regime whilst strongly negative in the high inflation regime for most WAMZ member countries.

However, in 2019, the authority of ECOWAS Heads of States adopted a single-track approach to monetary integration and adopted a 5 percent inflation target as one of the primary convergence criteria. Thus, there is need to conduct a comprehensive study on optimal inflation growth threshold to cover all individual ECOWAS countries. This will help determine how realistic the ≤ 5 percent inflation convergence criterion is. In addition, the ECOWAS Authority of Governments and Heads of State in 2019 adopted inflation targeting as the framework for the conduct of monetary policy in the Member States in order to tame high and rising inflation which has been persistent recently in the region. This study will help policy makers to set a realistic target that is consistent with the economic fundamentals and structure of the economies of ECOWAS, as reflected in the historical inflation and growth data of Member States.

Thus, as in the WAMI 2023 paper, the questions of interest to policymakers in the WAMZ include the following: Is 5 percent inflation still appropriate as one of the primary convergence criteria for monetary integration in the ECOWAS region? What is the threshold of inflation at which its effect on growth in individual ECOWAS countries is negative? What is the inflation-growth inflection point for each ECOWAS member state? What are the differentials in the optimal inflation growth threshold among ECOWAS member states? This study provided answer to these questions as well as insight for policy makers in the ECOWAS region.

Thus, this paper aims to investigate the existence and magnitude of an inflation threshold effect for individual ECOWAS countries, using a smooth transition regression (STR) methodology. The STR approach allows for a gradual and continuous change in the slope of the regression function as inflation crosses a certain threshold, rather than a sudden and discrete change as in the traditional threshold regression models. The paper also examines the potential sources of heterogeneity in the inflation-growth relationship across ECOWAS countries, such as differences in exchange rate regime, labour force, trade openness, and fiscal policy. The paper uses annual data for 15 ECOWAS countries over the period 1996 to 2022.

This paper contributes to the inflation knowledge by analysing the inflation growth nexus for some ECOWAS countries that have not been previously empirically investigated. That is, the paper provides empirical evidence on the inflation-growth nexus for a group of African countries that have experienced different inflation regimes and growth trajectories. The

paper also offers policy implications for the design of optimal monetary policies that can enhance growth and stability in the region.

The structure of paper is as follows. Section 1 contains the introduction whilst section 2 contains the stylised facts on inflation and economic growth in the ECOWAS region. Section 3 reviews both the theoretical and empirical literature. Section 4 contains the methodology and estimation procedure whilst section 5 presents and discusses the empirical results. Section 6 contains the conclusion and some policy recommendations.

2.0 Inflation and Economic Growth Trends across ECOWAS Member States

The pursuit of optimal inflation rates as a tool for fostering economic growth has been a persistent theme in macroeconomic policy discourse. The inflation rate in ECOWAS appears to be higher in the WAMZ region than the WAEMU countries occasioned on many reasons, one of such is that many of these countries do not share common currency. On the other hand, WAEMU member countries share a common currency, the West African CFA franc, pegged to the Euro, providing stability but limiting individual countries' monetary policy flexibility. The Central Bank of West African States (BCEAO) centralizes monetary policy for coordinated action and stable inflation. Adherence to economic convergence criteria, including limits on deficits and public debt, aims to promote fiscal discipline and stability in the region.

In contrast, WAMZ, part of ECOWAS, includes countries with diverse economic structures. Maintaining individual currencies, WAMZ countries lack a common currency like the West African CFA franc, resulting in varying exchange rates and more independent monetary policies. Economic divergence in WAMZ arises from differences in structures, fiscal policies, and the ability to tailor national monetary policies to specific challenges, leading to variations in inflation and growth rates.

Reasons for divergence include WAEMU's fixed exchange rate limiting currency adjustment flexibility, while WAMZ's variable exchange rate policies may yield different economic outcomes. Fiscal policy disparities exist within each union, with WAEMU attempting to harmonize policies, while WAMZ countries enjoy greater autonomy in fiscal policy design. Both unions face external shocks yet impacts vary based on individual economic resilience. The diversity in economic structures, sectors, and development levels contributes to variations in economic performance. Economic conditions are dynamic, and influencing factors on inflation and growth can change over time as shown in the tables below.

Tables 2.1 and 2.2 illustrate the inflation and growth patterns in the ECOWAS region, comprising both the West African Economic and Monetary Union (WAEMU) and West African Monetary Zone (WAMZ) Countries. The analysis clearly show that member countries display diverse experiences in both inflation and growth rates. Analysing the tables on inflation in the ECOWAS region over various periods reveals distinct trends and fluctuations across different countries, allowing insights into the relationship between inflation and GDP growth, along with potential economic reasons behind the numbers.

2.1 Analysis of Inflation and GDP Growth in WAEMU Countries (1996-22)

Benin consistently maintained relatively low and stable inflation, along with moderately high economic growth over the period under consideration. For instance, inflation began at 3.3 percent 1996-2002, decreased remarkably to 0.2 percent 2013-2017, and then experienced a slight increase to 1.2 percent 2018-2022. The trend initially moderated, followed by a significant decrease, the recent uptick may be attributed to changing economic conditions or external factors. GDP growth, starting at 5.0 percent 1996-2002 with fluctuations, reached 6.2 percent 2018-2022, indicating robust economic growth, possibly driven by diverse economic activities or policy initiatives. The real sector trend in Burkina Faso also witnessed similar pattern with inflation starting at 2.2 percent 1996-2002, peaking at 3.8 percent 2008-2012, decreasing to 0.6 percent 2013-2017, and slightly increasing to 3.7 percent 2018-2022. Fluctuations indicate economic adjustments, possibly linked to external factors. GDP growth, starting at 5.5 percent 1996-2002, with fluctuations, reached 4.5 percent 2018-2022, reflecting economic resilience. The recent decrease signals potential challenges or adjustments.

Cabo Verde demonstrated relatively stable inflation, starting at 2.3 percent 1996-2002 and reaching 1.3 percent 2018-2022, possibly resulting from effective policies. GDP growth, starting high at 9.1 percent 1996-2002, fluctuated and reached 3.3 percent 2018-2022. While the initial high growth indicates prosperity, fluctuations and a recent decrease underscore the need for economic diversification. In the case of Cote d'Ivoire, the country experienced fluctuating inflation, starting at 3.1 percent 1996-2002, peaking at 3.1 percent 2008-2012, decreasing to 1.1 percent 2013-2017, and slightly increasing to 2.2 percent 2018-2022. This suggests economic adjustments influenced by external factors or policy changes. GDP growth, starting at 0.1 percent 1996-2002 and reaching 5.4 percent 2018-2022, indicates recovery and expansion.

Guinea Bissau witnessed volatile inflation, starting at 4.2 percent 1996-2002, decreasing to 0.9 percent 2013-2017, and increasing to 2.7 percent 2018-2022. The recent increase may indicate recovery efforts or external influences. GDP growth, starting at negative 4.1 percent 1996-2002 and reaching 2.1 percent 2018-2022, reflects recovery and stabilization efforts. On another note, inflation in Mali started at 2.5 percent 1996-2002, decreased to 0.3 percent 2013-2017, and slightly increased to 1.1 percent 2018-2022. The decrease may result from structural issues, while the recent increase could be influenced by changing economic conditions. GDP growth, starting at 6.3 percent 1996-2002 with fluctuations, reached 3.0 percent 2018-2022, suggesting economic adjustments.

Niger exhibited generally low inflation, with a peak at 3.2 percent 2008-2012, decreasing to 1.0 percent 2013-2017, and increasing to 2.3 percent 2018-2022. Generally low inflation indicates economic stability. GDP growths are generally positive albeit with some level of fluctuations, reaching 5.9 percent between 2018-2022, signifying economic health. In the case of Senegal, data showed generally low inflation, with a peak at 2.2 percent 2008-2012 and a recent increase to 3.3 percent 2018-2022. The economy generally experienced positive GDP growth, reaching 4.6 percent between 2018-2022, indicating economic health with some level of fluctuations, which may pose instability. Lastly, Togo exhibited moderate inflation,

starting at 2.0 percent 1996-2002, with fluctuations and a recent increase to 3.1 percent 2018-2022. Moderate inflation correlates with positive GDP growth, reflecting economic responsiveness. The recent increase may be influenced by various factors, including global economic conditions. The economy also generally experienced positive GDP growth, reaching 4.8 percent 2018-2022, suggesting economic health, with fluctuations possibly influenced by external economic factors.

Table 2.1: Trend Analysis of Inflation and Growth in the WAEMU

WAEMU Countries	Indicators	1996-2002	2003-2007	2008-2012	2013-2017	2018-2022
Benin	INF	3.3	2.6	4.1	0.2	1.2
	GDP	5.0	3.9	3.4	4.9	6.2
Burkina Faso	INF	2.2	2.0	3.8	0.6	3.7
	GDP	5.5	6.3	6.1	5.2	4.5
Cabo Verde ¹	INF	2.3	1.9	3.4	0.2	1.3
	GDP	9.1	8.9	2.5	2.2	3.3
Cote d'Ivoire	INF	3.1	2.6	3.0	1.1	2.2
	GDP	0.1	0.7	3.5	8.4	5.4
Guinea Bissau	INF	4.2	1.5	3.7	0.9	2.7
	GDP	-4.1	2.6	3.5	4.5	2.1
Mali	INF	2.5	1.0	4.2	0.3	1.1
	GDP	6.3	5.1	3.5	5.3	3.0
Niger	INF	2.4	1.3	3.2	1.0	2.3
	GDP	4.1	3.8	6.2	5.4	5.9
Senegal	INF	1.6	2.0	2.2	0.4	3.3

	GDP	4.1	3.9	3.0	5.8	4.6
Togo	INF	2.0	1.9	4.0	1.0	3.1
	GDP	0.8	0.5	5.7	5.5	4.8

Source: World Economic Indicators

¹ Note that Cabo Verde is not a member of the WAEMU and just included for completeness purpose in most of the Tables.

In sum, it is crystal clear that many WAEMU countries consistently maintained relatively low and stable inflation, along with moderately high economic growth over the period under consideration. Suggesting that inflation and GDP growth patterns contrast, with generally low and stable inflation associated with positive GDP growth, indicating economic stability. Although, some level of challenges and adjustments are evident in some countries, emphasizing the need for diversified economy.

2.2 Analysis of Inflation and GDP Growth in WAMZ Countries (1996-2022)

In The Gambia, inflation increased from 3.8 percent 1996-2002 to 7.7 percent 2018-2022, with fluctuations indicating overall increase. Varied GDP growth, reaching 4.6 percent 2008-2012 and 4.6 percent 2018-2022, reflects positive growth. In the case of Ghana, the country recently experienced a significant decrease in inflation from 22.1 percent 1996-2002 to 13.2 percent 2018-2022. GDP growth rates appear to be oscillating, reaching 9.0 percent between 2008-2012 and 4.4 percent 2018-2022. The connection between inflation rate and economic expansion highlights the need for continued policy efforts.

Guinea unveiled a significant decrease in inflation from 15.3 percent 1996-2002 to 10.6 percent 2018-2022, indicating improved economic stability. Mixed GDP growth rate was also observed, reaching 6.5 percent between 2013-2017 and 5.1 percent between 2018-2022. In another vein, Liberia's inflation varied with peaks at 11.1 percent 1996-2002 and 14.9 percent 2018-2022, indicating inflationary pressures. Heterogenous GDP growth are witnessed, with negative growth in 2008-2012 and 2018-2022, suggesting economic challenges.

Nigeria presented moderate inflation with significant peaks between 11.1 percent and 14.5 percent. Wide-ranging GDP growth, reaching 7.1 percent (2003-2007) and decreasing to 1.8 percent 2018-2022, are experienced. Addressing most of the factors leading to inflationary pressures and stimulating positive GDP growth are imperative for economic development. In the case of Sierra Leone, data indicated a high inflation rate with some level of variabilities, showing a high of 11.1 percent (2003-2007) and 16.7 percent 2018-2022. Various GDP growth rates are witnessed in the economy, reaching 7.3 percent 2008-2012 and decreasing to 2.9 percent 2018-2022. Adopting policies and programmes that will tame contributing factors to the recent increase in inflation are essential for sustainable economic growth.

Table 2.2: Trend Analysis of Inflation and Growth in the WAMZ

WAMZ Countries	Indicators	1996-2002	2003-2007	2008-2012	2013-2017	2018-2022
The Gambia	INF	3.8	8.7	4.6	6.7	7.7
	GDP	3.6	2.8	3.2	2.5	4.6
Ghana	INF	22.1	17.1	13.3	14.8	13.2
	GDP	4.3	5.5	9.0	4.8	4.4
Guinea	INF	15.3	17.1	15.9	9.4	10.6
	GDP	3.8	2.9	3.9	6.5	5.1
Liberia	INF	11.1	9.3	9.5	9.3	14.9
	GDP	4.5	-0.9	6.9	2.1	1.1
Nigeria	INF	11.1	12.1	12.2	11.6	14.5
	GDP	5.9	7.1	6.5	3.0	1.8
Sierra Leone	INF	8.0	11.1	7.2	9.2	16.7
	GDP	5.3	6.5	7.3	3.0	2.9

Source: World Economic Indicators

Key insights in WAMZ countries reflects that inflation and GDP growth patterns vary, with some countries exhibiting decreased inflation, indicating improved economic stability. Varied GDP growth suggests economic challenges, while positive growth may be linked to specific periods of economic activity or policy initiatives. Peaks in inflation may reflect external factors, policy challenges, or economic adjustments. Negative GDP growth in Liberia and recent decreases in Nigeria and Sierra Leone highlight economic challenges.

In summary, stable relationships between inflation and GDP growth suggest a generally healthy economic environment, with disparities in inflation across countries attributed to

variations in monetary policy regimes and broader macroeconomic strategies. The specific economic context of each country plays a crucial role in understanding the dynamics between inflation and GDP growth. It should be noted that Benin, Cabo Verde, Cote d'Ivoire, Burkina Faso, Guinea-Bissau, Mali, Niger, Senegal, and Togo consistently maintained lower single-digit inflation throughout the reviewed period. Notably, countries in the CFA zone, using the CFA franc pegged to the Euro, adopt a common currency and implement a fixed exchange regime to maintain low inflation. Within the WAMZ Zone, Ghana is the only inflation-targeting regime, while other member countries adopt either a monetary targeting and/or a managed float exchange rate regime, hence, many of the WAMZ countries tends to have higher inflation rate in the period under review (African Development Bank Group, 2017). Though there is need to empirically determine the optimal inflation-growth threshold for these countries.

3.0 Literature Review

From the theoretical perspective, different schools of thought have classified the Inflation-growth nexus as either negative, positive, or nonlinear. The classical school of thought argued that the relation between inflation and economic growth was negative, and that growth was enhanced through other factors such as land, investment, and population growth. The Keynesian on the other hand postulated that the relationship between inflation and growth is positive, accentuating that price increase will lead to an increase in production by firms to satisfy consumer demand. Furthermore, the endogenous growth theory assessed the inflation-growth nexus from capital accumulation stands. The theory reasoned that higher inflation adversely affects real return on deposit by slowing growth in deposit. Given that deposit is a fraction of capital and capital a factor of production, a decrease in deposit would lead to a decline in capital accumulation and subsequently lower output growth. Moreover, Tobin's effect proposed that inflation impedes real interest rate and consequently the opportunity cost of investment, however the promotion of physical capital accumulation can stimulate output growth. Inflation above a certain threshold, the reverse Tobin-effect will become evident, and inflation impact on growth is seen as negative (Vaoni, 2012). Additionally, Khan (2014), elucidated the reverse Tobin-effect phenomenon, stating how high inflation distorts relative prices and is also accountable for the misallocation of resources and has the tendency to hamper physical capital accumulation and consequently impedes economic growth.

Diverging from traditional model, Fisher (1993) suggested that the relationship between inflation and economic growth is non-linear, explaining that there exists a threshold effect, below a certain threshold the relation is positive and above, a negative relationship will occur. In the same vein, Thanh, 2015; Eggoh and Khan (2014); Seleteng et. al. (2013); Lopez-Villavicencio and Mignon (2011); and Khan and Senhadji (2001), all in their findings suggested that inflation effect on growth could be neutral or positive below a certain threshold but unfavourable to growth above the threshold level.

A substantial amount of academic research has been carried out gauging the threshold effects of inflation on economic growth in the WAMZ region. This includes WAMI (2023), which analysed this issue for individual member states of the West African Monetary Zone

(WAMZ). Result based on smooth transition regression model revealed the six (6) WAMZ countries namely The Gambia, Ghana, Guinea, Liberia, Nigeria, and Seirra Leone inflation threshold were 6.6 percent, 10.2 percent, 10.8 percent, 8.7 percent, 10.8 percent, and 7.4 percent, respectively. These coefficients were statistically significant at the 5 percent conventional level apart from the coefficient of The Gambia that was found to be inconclusive. Sanga and Gui-Diby (2020), carry out a study on inflation-growth threshold on the Franc Zone (scope 1970-2018), using the co-integration method for estimation. The analysis shows that inflation threshold level can be adjusted between 5.4 - 5.6 percent for Central African Monetary Union (CAMU) and 4.3 - 4.5 percent for West African Economic and Monetary Union (WAEMU) above which inflation adversely affect Growth. Additionally, the West African Monetary Authority, WAMA (2018), in their optimal inflation growth threshold analysis for ECOWAS countries using the Khan and Sanhadji (2001) non-linear regression technique, found the optimal inflation rate for the ECOWAS region to be 6 percent, with 3 percent for UEMOA and 9 percent for the WAMZ. Optimal inflation level differs among countries depending on the existing economic structure and other macroeconomic factors including investment, trade openness, exchange rate regime, government consumption/expenditure and population growth (Nguyen, 2018; Ndou and Gumata, 2017; and Fisher, 1993). Asigbetse et al (2022), in a study analysing the Ghanaian economy (1980-2019), found different impacts of relations between inflation and sectoral growth depending on the structure of the economic sector.

There are also channels through which inflation transmits adversely or favourably to growth. One channel is through the financial system. In the credit market for example, an increase in inflation discourages lenders because of the reduction in the real return on asset(s) and subsequently causing decreases in available funds for lending. Also, inflation increases the risk of credit default(s) by new borrowers and creates a situation where the credits are rationalized by financial institutions. Thus, high inflation has an adverse consequence on economic growth. On the other hand, lower-level inflation brings about the Mundell-Tobin effect, promoting economic growth (Choi et al 1996). Another channel to consider is the fiscal policy channel. While the classicals and Neoclassicals perceived that fiscal policy has minimum impact on economic growth due to the crowding out effect, the Keynesians believed that fiscal policy has the propensity to induce output. WAMI (2022), assessed the fiscal policy channel in the transmission mechanisms analysis of inflation growth in the WAMZ. Results showed a nonlinear relationship between inflation and economic growth. The findings also indicated that moderated inflation below the threshold of 10.3 percent can accelerate output growth when government consumption remains below the threshold of 7.47 percent of GDP. Notwithstanding, higher government consumption adversely amplifies the effect of inflation on growth in WAMZ when government consumption exceeds this threshold. Additionally, the findings highlighted the importance of improving policy coordination between the fiscal authorities and monetarity authority (central banks) to deliver a more efficient macroeconomic environment to foster sustainable economic growth across the Zone. Exchange rate regimes have also been seen to impact inflation although theories remain vague. The strongest link between exchange rate regimes and inflation was with the fixed or peg exchange rate regime. (Ghosh et al 1997). An economy operating under a peg exchange rate regime could achieve

low inflation, however, there is a chance that lower output growth would be achieved. Notwithstanding, both theoretical and empirical findings remained inconclusive on the degree of influence the exchange rate regime can have on inflation and growth because of the many ways exchange rate can impact and be impacted by other macroeconomic variables. However, in a similar vein, Perpetua (2014), when analysing the Nigerian economy that operated a manage float exchange rate regime (scope 1980-2010), found that an increase in the volatility of the exchange rate led to an increase in inflation and the relationship with economic growth was negative. While the findings showed that exchange rate volatility and high inflation was detrimental to economic growth, it was also revealed that moderated and stable inflation enhances return on savings and investment and subsequently fosters economic growth.

Overall, a large amount of literature points out that high and unexpected inflation levels stifles economic growth, affecting both production and consumption, while lower-level inflation could be ideal for economic growth, with the impact transmitted through different channels depending on the countries' economic structure.

4.0 Methodology

4.1 Estimation Technique

The aim of this paper is to investigate the relationship between inflation and economic growth in individual ECOWAS member states by testing for the existence of a threshold effect. That is to determine the optimal inflation that spurs growth and beyond which inflation will be detrimental to growth. To achieve this, we adopted the smooth transition regression (STR) technique developed by Terasvirta (1994). The assumption of threshold models is that at any point in time, the dependent variable is governed by more than one regime. Thus, STR models allows for a nonlinear and smooth adjustment of the explanatory variable to changes in the independent variables. The STR model assumes a sudden and discrete switch between different regimes. Unlike conventional threshold regressions, the STR model allows for a gradual shift between/ among regimes making it more attractive to modellers. There are two variants to the STR model. First, a variant that the model parameters adjust conditional on the position of transition variables relative to the transition value. That is depending on whether the transition variables are below or above the transition value. Second, a variant wherein the model parameters adjust conditional on the distance between the transition variable and the transition value.

The main advantage of the STR model over other threshold models' is that it can capture more realistic and gradual transitions between/ among regimes, whilst at the same time accounting for possible asymmetries and hysteresis effects. In sum, it allows us to estimate two-regime with unknown parameters for the shape and location of the smooth threshold, and when an observed variable crosses the unobserved thresholds, the regime switching occurs smoothly. This is because the model uses continuous transition functions that capture the gradual shifts in the model behaviour. Consequently, STR models frequently display more "accurate" dynamics relative to other threshold regression.

The use of STR models to investigate nonlinearities in economic relationships is common in the empirical economic literature. This is because STR model has more appealing features relative to other non-linear models (Fouquau et al., 2008; Kilic, 2016; Anderl and Caporale, 2022; Abir and Nefzi, 2022). In view of this, this paper adopted the STR estimation technique to determine the optimal inflation growth threshold for individual ECOWAS member countries, following the framework developed by Terasvirta (1994).

This model allows us to exploit the heterogeneity in inflation rates and detect possible nonlinearity through the variations in the effect of inflation on growth overtime. By allowing for such variations in the parameter estimates, the STR model offers a suitable framework to tackle the problem of structural breaks. It ensures the endogenous determination of the inflation threshold parameter that will support growth above which high inflation can possibly be detrimental to growth. Evidence shows that the STR model can mitigate potential endogeneity biases (Fouquau et al., 2008). This occurs through the smooth change in the coefficients from one regime to another depending on the threshold variable.

The standard STR model is specified as shown in equation (1):

$$y_t = \beta_1 y_{t-1} + \beta_2 y_{t-1} \cdot G(z_{t-d}, \gamma, c) + \varepsilon_t \quad (1)$$

Where β_1 is the coefficient vector of the linear part, β_2 is the coefficient vector of the non-linear part, y_t is a vector of the explanatory variables including inflation, ε_t is a vector of stochastic white noise disturbances and $G(z_{t-d}, \gamma, c)$ is the transition function. The transition function is a continuous function of the inflation threshold variable and is normalized to range between 0 and 1. It depends on the transition variable z_{t-d} , the slope parameter γ , and the location/ threshold parameter c . The smoothness of the transition function and the threshold value are determined by γ and c respectively. The transition variable z_{t-d} represent an exogenous variable that has a delay parameter d . Furthermore, equation (2) is specified as the basis for the determination of the transition regimes and the STR allows for smooth transition depending on the transition variable z_{t-d}

$$y_t = \begin{cases} \beta_{10} + \beta_{20} y_{t-1} + \varepsilon_{1t} & \text{if } z_{t-d} \leq c \\ \beta_{11} + \beta_{21} y_{t-1} + \varepsilon_{2t} & \text{if } z_{t-d} > c \end{cases} \quad (2)$$

Terasvirta (1994) identified two different STR model with different degree of regressive decay, i.e. the exponential STR and the logistic STR. In addition, Escribano and Jordá,(2001) proposed an improved LM test to choose between the two STR models. The transition function of the logistic form of the STR model is given as:

$$F(z_{t-d}, \gamma, c) = \frac{1}{(1 + \exp\{-\gamma(z_{t-d} - c)\})} \quad (3)$$

The Logistic function value is bounded between 0 and 1 and it depends on the transition variable z_{t-d} as follows: if $z_{t-d} \rightarrow -\infty$, $F(z_{t-d}, \gamma, c) \rightarrow 0$, $F(z_{t-d}, \gamma, c) = 0.5$ for $z_t = c$, and $F(z_{t-d}, \gamma, c) \rightarrow 1$ as $z_t \rightarrow +\infty$. The transition variable (z_{t-d}) and the transition parameter (γ) determine the speed of reversion. In other words, given a specific value of the transition

variable, the speed of transition between regimes is determined by the transition parameter (γ) and as such, low values of the transition parameter imply slower transition. Thus, the threshold parameter (c) is interpreted as the threshold between the two regimes corresponding to when the transition function takes the value 0 and 1, i.e. $F(z_{t-d}, \gamma, c) = 0$ and $F(z_{t-d}, \gamma, c) = 1$. The logistic function changes monotonically and can depict asymmetric behaviour between negative and positive deviations of z_{t-d} from c . The logistic model specifically accounts for asymmetries in inflation arising due to increase or decrease in the threshold of inflation-growth (Kilic, 2016; Anderl and Caporale, 2022).

The transition function for the exponential form is as follows:

$$G(Z_{t-d}, \gamma, c) = 1 + \frac{1}{\exp(-\gamma(Z_{t-d} - c))} - \frac{1}{2}$$

The parameters are as described above but the exponential function changes symmetrically around the threshold parameter c , unlike the logistic function which changes monotonically. This implies that interpretation of the results differs based on the form of the transition function used. The strength of the logistic model over the exponential model is its ability to explain asymmetric behaviour between negative and positive deviations of Z_{t-d} from c . On the contrary, the exponential model provides for symmetric behaviour of negative and positive deviations but considers the distance of Z_{t-d} from c .

4.2 Model Specification

To determine the optimal inflation growth threshold for individual ECOWAS countries, we analysed both the linear and non-linear part of the data overtime as commonly used in the nonlinear empirical literature. Following Terasvirta (1994), the STR model is estimated for each individual ECOWAS member countries using time series data for the period 1996 to 2022 using the model specified below:

$$\Delta g_t = \alpha_0 + \delta_1 \Delta g_{t-1} + \varphi_1 \Delta p_t + \theta_1 \Delta q_t + \omega_1 \Delta n_t + \gamma_1 \Delta s_t + \mu_1 \Delta b_t + \pi_1 \Delta r_t + [\alpha_0 + \delta_1 \Delta g_{t-1} + \varphi_1 \Delta p_t + \theta_1 \Delta q_t + \omega_1 \Delta n_t + \gamma_1 \Delta s_t + \mu_1 \Delta b_t + \pi_1 \Delta r_t] \cdot G_t + \varepsilon_t \quad (4)$$

where g_t is real GDP growth, $t = 1, \dots, T$ represent the time dimension, which is 1996-2022, p_t is inflation rate our main variable of interest. Also, other standard control variables that contributes to growth are considered. They include, the initial level of real GDP growth rate (GDP g_{t-1}), investment represented by the growth rate of gross fixed capital formation q_t , growth rate of terms of trade n_t , growth rate of nominal exchange rate s_t , growth rate of oil price (Brent crude) a proxy for oil price shock b_t , growth rate of population r_t and ε_t is the error term.

Notably, economic theory suggests that inflation can aid economic growth in the low inflation regime below the threshold parameter, but above the threshold parameter, i.e. the high inflation regime, inflation is detrimental growth. The effect of inflation on growth below the

threshold is positive and is consistent with Tobin's effect, which argues that inflation leads to lower real interest rate and by extension, lower opportunity cost of investment, promoting physical capital accumulation and stimulating growth (Vaoni, 2012). On the other hand, when inflation is higher than the threshold, the effect on growth is negative reflecting the detrimental effect of inflation on growth resulting from decreasing capital stock induced by higher inflation. This situation is consistent with the reverse Tobin-effect phenomenon which suggest that high inflation would create distortions to relative prices and misallocation of resources which potentially hinders physical capital accumulation and impedes growth (Khan, 2014).

The relationship between growth and the control variables is significant in both low and high inflation regimes. As expected by Tobin's effect, low inflation can boost economic growth by increasing the coefficient of the growth rate of gross fixed capital formation. However, when inflation exceeds the threshold, the reverse-Tobin effect occurs, which means that physical capital accumulation has a negative impact on growth in the high inflation regime.

The hypothesis of conditional convergence implies that the coefficient on initial income should be negative, according to the Neoclassical growth literature. Additional control variables such as dynamics of population growth are also included to examine the robustness of the results and to account for its effect on growth. Growth in terms of trade reflects the effects of external shocks on economic growth. The nominal exchange rate changes variable is used to control for possible pass-through effects of exchange rate fluctuation (Nguyen, 2018; Arisen, Managuinhane, and Simione, 2021). Moreover, different measures of exchange rate are used alternatively to assess the sensitivity of the results to changes in this variable. For example, the real exchange rate misalignments variable is used to capture possible negative effects of persistent misalignments on growth through distortions to relative prices of traded to non-traded goods that affect the decisions of economic agents which may generate instability (Bereau, Villavicencio, and Mignon, 2009).

We used a linearity test to check if there is a linear relationship between inflation and economic growth, or if the STR model fits better. This test helps us to see if inflation and economic growth have a nonlinear relationship in the ECOWAS region. To do this, we test the null hypothesis of homogeneity, $H_0: \gamma=0$ or $H_0: \beta_0=\beta_1$, which means the STR model is not needed. This test involves comparing a linear model ($r=0$) with the STR model with one transition function ($H_0:r=1$) or two different regimes. The test is based on the p-values of the Wald, Fisher and Likelihood ratio test statistics. If we reject the null hypothesis of linearity, it means the relationship is nonlinear, and we need to do more tests to find out the number of location parameters and transition functions. We also do more tests to make sure there are no other nonlinearities in the relationship. This depends on the p-values of the three tests, which should all fail to reject the null hypothesis. To check the reliability of the results, we estimate different versions of the STR model to see if the results of nonlinearity and the growth effects of inflation change with different control variables.

4.3 Description of Data

We employ a time series method to analyse data from all ECOWAS countries, excluding Cabo Verde, for the period 1996 -2022. The data availability for each country determined the selection of the study period. Cabo Verde was excluded in the study due to the unavailability of data for majority of the variables and study period on all major economic databases. The variables used in this study are described in Appendix 1.

The dependent variable, growth rate of real GDP was measured as the first difference of the logarithm of real GDP obtained from the World Bank World Development Indicators (WDI) database. Inflation, which is our threshold variable, was computed as the first difference of the logarithm of the annual CPI and was sourced from the WDI database. The control variables include investment represented by Gross Fixed Capital Formation, growth rate of terms of trade, growth rate of nominal exchange rate, initial income, growth rate of oil price (Brent crude), which is a proxy for oil price shock and population growth.

The terms of trade (TOT) variable were computed as the ratio of the price level of exports to the price level of imports and growth in TOT was obtained as the first difference of the logarithm of TOT. Data on nominal exchange rates was obtained from the WEO database and the World Bank's World Development Indicators (WDI). The growth rate of exchange rate is obtained as the log difference of the nominal exchange rates i.e., $\Delta NEX_t = \ln(NEX_t) - \ln(NEX_{t-1})$ where NEX represents the nominal exchange rate, which is defined in terms of the units of the local currency to the US dollar. Data on oil prices (brent crude) is obtained from the Statista data base and the growth rate was computed as the first difference of the logarithm of Brent Crude Oil Price. Data on population was obtained from the WDI database, and the growth rate was computed as the first difference of the logarithm of total population.

5.0 Presentation and Discussion of Results

This section presents and discusses the empirical findings on the possible existence of inflation threshold above which inflation becomes harmful to growth in Member States of ECOWAS, consisting of both UEMOA and WAMZ Countries. The smooth transition regression (STR) model is used to endogenously determine the presence of such threshold effects at the country level covering the period of 1996-2022. The analysis is an extension of a recent policy study (WAMI, 2023) which utilises STR model to analyse the inflation-growth nonlinearity relationship in the WAMZ over the period 1996-2021.

We consider the time series properties of all the variables used in the STR model as it is germane to ensure that all the variables are stationary. In doing this, we estimated the model using the growth rate of the variables as shown in equation (4). This empirical specification is consistent with recent empirical studies that have applied the STR model (Fouquau et al., 2008; Kilic, 2016; Anderl and Caporale, 2022; WAMI 2023). This study coverage period starts from 1996 because of data unavailability for key variables of interest for some ECOWAS Member States.

5.1 Descriptive Statistics

The descriptive statistics for the variables used in the regression during 1996-2022 is also not presented to avoidance of clumsiness of the results. The statistics show significant variations in the variables of interest (growth in real GDP, inflation rate and other control variables) for the ECOWAS countries over time. The data also shows significant heterogeneity in levels of average annual inflation and economic growth rate over time. Similarly, other control variables vary substantially across countries and overtime. It points to a potential nonlinear association between inflation and economic growth in the region. As revealed in the results, inflation is likely to be beneficial to economic growth up to a certain threshold, above which it can potentially dampen growth of these economies. Overall, the description of the variables of interest shows that there is significant variation in inflation rate, gross fixed capital formation, terms of trade, nominal exchange rate and growth rate of population over time. These are interesting features of the dataset that reinforce our view of the suitability of the STR model to exploit such heterogeneity and explore the possible nonlinearities in the relationship between inflation and economic growth in each of the ECOWAS member states.

5.2 Unit Root Test

There is a growing consensus among scholars that the traditional tests used in empirical research to test for the existence of non-stationary series (presence of unit roots) such as the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests have low power especially in the presence of structural breaks in nonlinear time series. Given this argument, it is helpful to analyse the time series properties of the variables taking into consideration the second-generation tests such as Zivot and Andrews (1992), Elliott, Rothenberg, and Stock (1996), Kwiatkowski, Phillips, Schmidt and Shin (1992), Ng and Perron (2001).

The results of the unit root tests for nonlinear time series by applying the test proposed by Kwiatkowski, Phillips, Schmidt and Shin (1992) was carried out but we could not present them due to avoidance of clumsiness of the results. Also, there is limited number of data points used (26 observations), hence, problem of unit root is not very critical in such situation. Nonetheless, we considered all options, intercept only, intercept and trend, and the appropriate lag length, the results indicate that all the variables expressed in growth rates are stationary or integrated of order zero ($I(0)$) at 1 and 5 percent significance levels for all ECOWAS countries. The stationarity of the series implies that the STR model is a suitable estimation technique to determine the possible existence of the threshold effects of inflation on economic growth in these countries.

5.3 Linearity and Remaining Nonlinearity Tests

To obtain the inflation threshold value, it is useful to determine whether there exists a nonlinear relationship between inflation and economic growth in each Member State. All the results Tables (5.1 to 5.15) display the linearity tests against the STR alternatives. For brevity of presentation, we could not present other alternative results of these tests for all ECOWAS Member States. The test results show strong rejection of the null hypothesis of linearity at the

5 percent level across all countries. This finding indicates that there exists a nonlinear relationship between inflation and economic growth in each country. The outcome is consistent with the findings from the policy study conducted by WAMI (2023) which illustrates strong nonlinear inflation-growth relationship by applying the STR model across the WAMZ countries. It considers nonlinearity to endogenously determine the inflation threshold beyond which inflation is detrimental to growth.

We performed further test of nonlinearity in the data using the additive nonlinearity tests. Considering the decision rule for estimation of the STR model using the Terasvirta Sequential and Escribano-Jorda tests, our results strongly indicate that a first-order logistic smooth transition regression (LSTR) model should be estimated to capture the nonlinear relationship in the inflation-growth nexus for each country.

5.4 LSTR Model Estimation

Following the determination of the suitability of the estimation of the LSTR model, equation (3) is estimated using the LSTR model by applying the nonlinear least squares to analyse the inflation-growth nonlinearity in each country. The estimation of the LSTR allows us to determine the inflation threshold (location parameter), analyse the behaviour of inflation in both low inflation regime below the threshold and above the threshold in the high inflation regime. The estimation produces the value for the slope parameter (γ), which shows the extent to which inflation above the threshold can quickly become harmful to growth. In estimating the LSTR model, the threshold value and slope coefficient are determined by a grid search. We utilised the Broyden, Fletcher, Goldfarb and Shanno (BFGS) iteration process in the estimation allowing the default of 500 iterations (see Eviews 13 manual for details).

5.5 The WAEMU/UEMOA Region of ECOWAS

For clarity and ease of comparison of estimated threshold inflation-growth in the ECOWAS region, we would first present results for the West African Economic and Monetary Union (WAEMU- also known as UEMOA in French) countries (Tables 5.1 to 5.8), given that there are substantial data gap for Cabo-Verde, especially for key variables of interest for larger part of our estimated period, we omitted the country in the analysis. In the second part, we would present the updated results for the WAMZ Member States (Tables 5.9 to 5.14). It must be noted that the estimated results displayed are divided into three important components, comprising the linear, nonlinear and threshold parts. Given the focus of this study, more attention will be paid to the threshold part, where we would analyse the estimated inflation threshold, slope parameter (γ) and relevant regression statistics over the period 1996-2022. As stated earlier, the objective is to examine the threshold effect of inflation on growth and associated slope parameter, which allows us to determine the smoothness of the transitions from the lower to upper inflation regimes with a view to evaluating the speed at which the level of inflation above estimated threshold becomes detrimental to growth. Given this objective, the analysis focuses largely on the estimated inflation threshold, the direction of the coefficient of inflation in both the lower and upper inflation regimes in assessing the possible existence of a nonlinear effect of inflation on growth and the value of the slope parameter.

The WAEMU Region of ECOWAS

5.5.1 Benin

Table 5.1 presents the parameters from the nonlinear estimation of the LSTR model with one threshold level of inflation for Benin Republic. The estimation results indicate a threshold value of inflation of 1.33 percent which is statistically significant at the 1 percent significance level. This finding suggests that implementing a menu of policies that would ensure that inflation is attained below the threshold of 1.33 percent would support economic growth. Above this threshold, inflation would be harmful to growth. This outcome is reflected in the direction of inflation effects on growth, which is consistent with the predictions on the inflation-growth nonlinear relationship. The coefficient on inflation in the low inflation regime (0.2954) below this threshold associated with the linear aspect of the estimation is positive but not statistically significant. Above the threshold associated with the nonlinear component of the estimation, the effect on growth is negative (-0.2899), reflecting detrimental growth effect of inflation although not statistically significant. The insignificant effect of inflation in both the low and high inflation regimes could be partly attributed to the limited number of observations used in the estimation, considering the relatively short study period which is divided into low and high inflation regimes associated with the linear and nonlinear components of the estimation.

Table 5.1 reports the inflation threshold value, smoothening slope parameter (γ) associated with the inflation threshold and corresponding confidence intervals of both the threshold level of inflation and the slope parameter at the confidence intervals of 90 percent, 95 percent, and 99 percent, respectively. The inflation threshold at the 95 percent confidence level is estimated to be 1.33 ± 0.0052 . While the slope coefficient is not statistically significant, the magnitude of the parameter suggests a steep transition function (see Figure 5.1). The shape of the transition function implies that inflation quickly becomes harmful to growth when it exceeds the threshold of 1.33 percent.

Table 5.1: Smooth Transition Inflation Threshold for Benin

		90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DLCPI(-1)	0.2954	-0.1099	0.7006	-0.2029	0.7936	-0.4133	1.0040
INVEST	-0.0548	-0.2443	0.1346	-0.2877	0.1781	-0.3861	0.2765
DLTOT	-0.3835*	-0.7078	-0.0592	-0.7821	0.0152	-0.9505	0.1835

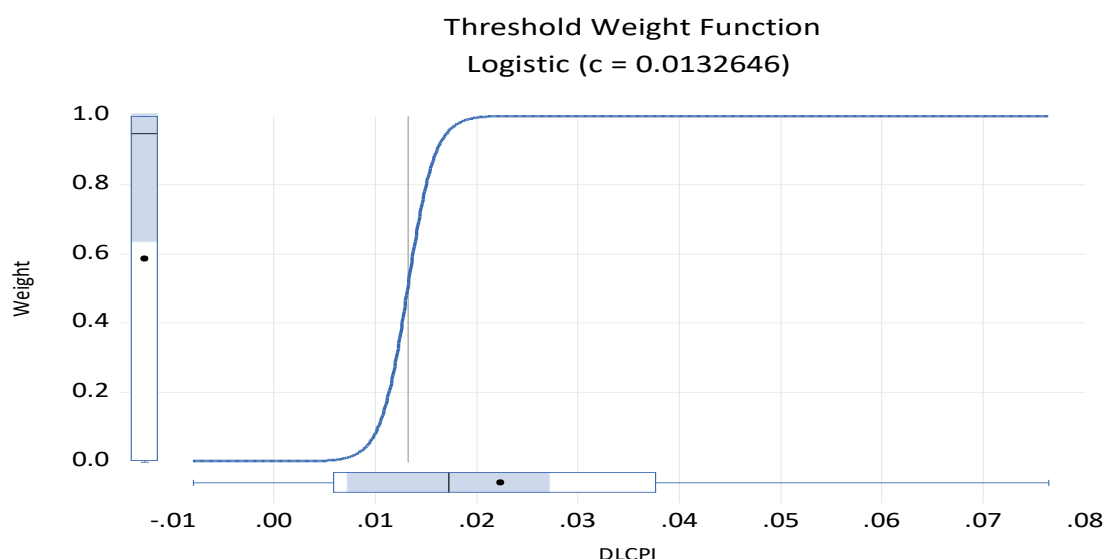
DNEXC	0.0066	-0.0734	0.0867	-0.0918	0.1051	-0.1334	0.1467
DLOPEN	0.1170	-0.0094	0.2434	-0.0384	0.2724	-0.1040	0.3380
DLPOP	3.0696	-11.9181	18.0574	-15.3555	21.4947	-23.1380	29.2772
Nonlinear Part							
DLCP1(-1)	-0.2899	-0.8501	0.3702	-0.9785	0.3986	-1.2694	0.6895
INVEST	0.1943	-0.0743	0.4629	-0.1359	0.5245	-0.2753	0.6640
DLTOT	0.3858*	0.0397	0.7319	-0.0397	0.8113	-0.2194	0.9910
DNEXC	0.0516	-0.0330	0.1362	-0.0524	0.1556	-0.0964	0.1995
DLOPEN	-0.0720	-0.2018	0.0577	-0.2316	0.0875	-0.2989	0.1549
DLPOP	-11.4613	-29.5891	6.6666	-33.7467	10.8241	-43.1597	20.2371
Threshold Part							
C	-0.1153	-0.4801	0.2496	-0.5637	0.3332	-0.7532	0.5226
Slope	758.8816	-2306.9150	3824.6780	-3010.0380	4527.8020	-4601.9760	6119.7390
Threshold	0.0133**	0.0091	0.0175	0.0081	0.0184	0.0059	0.0206
Confidence Level		0.0133±0.0042		0.0133±0.0052		0.0133±0.0073	
R-squared	0.7619						

Adj. R-squared	0.4285						
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Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5.1: Smooth Transition Function for Benin's Inflation Threshold



5.5.2 Burkina Faso

Table 5.2 presents results of the LSTR model for inflation-growth threshold in Burkina Faso. The results indicate an optimal inflation value of 2.00 percent and was statistically significant at the 1 percent significance level. The coefficient of inflation in the linear part of the model is positive (0.9481) and statistically significant at the 5 percent confidence interval. Whilst at the nonlinear part, the coefficient of inflation is negative (-1.4499) and statistically significant at the 5 percent confidence interval. The implication of this result is that below the optimal threshold of 2.00 percent, inflation can support growth but above the threshold of 2 percent, inflation is detrimental to growth. Thus, adopting policies that keep inflation below 2 percent in Burkina Faso can have positive impact on economic growth.

Table 5.2 also shows the inflation threshold value, the smoothing slope parameter (γ) associated with the inflation threshold and their corresponding confidence intervals, at their 90, 95 and 99 percent confidence intervals respectively. At the 95 percent confidence interval, the inflation threshold is estimated to be 0.0200 ± 0.0132 . The slope coefficient is statistically significant at 1 percent, the magnitude of the parameter suggests a steep transition function (see Figure 5.2). The shape of the transition function implies that inflation quickly becomes harmful to growth when it exceeds the threshold of 2.00 percent.

Table 5.2: Smooth Transition Inflation Threshold for Burkina Faso

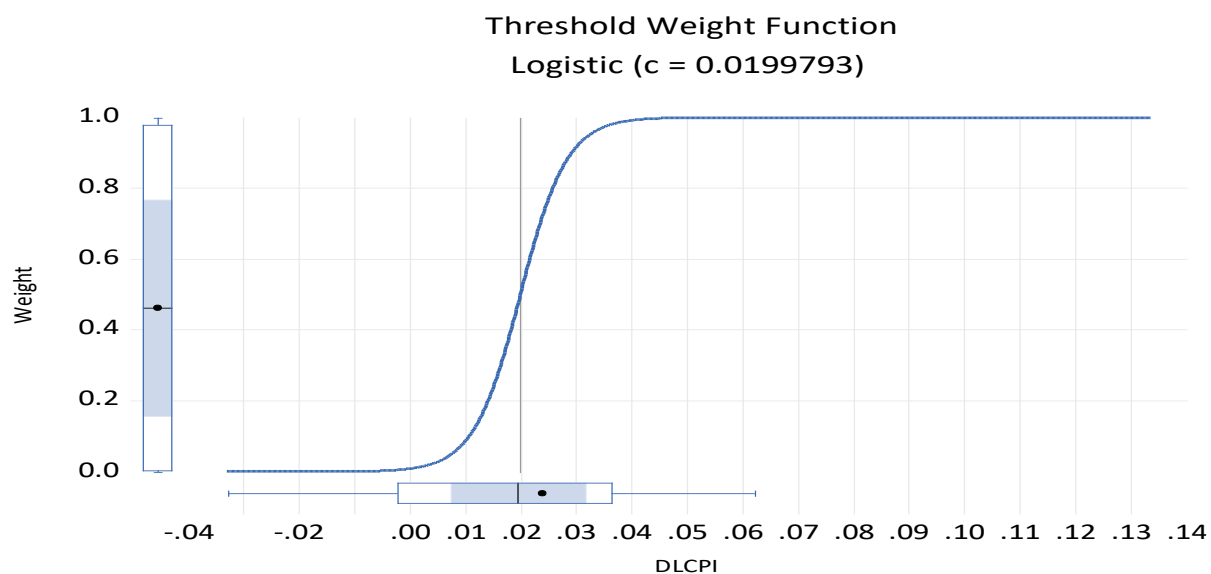
		90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DLCP1(-1)	0.9481**	0.2830	1.6132	0.1305	1.7657	-0.2149	2.1111
INVEST	0.0544	-0.0350	0.1438	-0.0556	0.1643	-0.1020	0.2108
DNEXC	0.0001	-0.0002	0.0003	-0.0002	0.0004	-0.0003	0.0005
DLTOT	0.0337	-0.0286	0.0960	-0.0429	0.1103	-0.0752	0.1427
DLOPEN	-0.0218	-0.1510	0.1074	-0.1806	0.1371	-0.2477	0.2042
DLPOP	-0.8453	-6.4457	4.7551	-7.7301	6.0395	-10.6382	8.9475
Nonlinear Part							
DLCP1(-1)	-1.4499**	-2.4756	-0.4242	-2.7108	-0.1890	-3.2434	0.3436
INVEST	-0.1023	-0.2842	0.0796	-0.3259	0.1213	-0.4203	0.2157
DNEXC	-0.0003	-0.0008	0.0001	-0.0009	0.0002	-0.0011	0.0004
DLTOT	-0.0745	-0.1659	0.0169	-0.1869	0.0379	-0.2343	0.0854
DLOPEN	0.0389	-0.1715	0.2492	-0.2197	0.2975	-0.3289	0.4067
DLPOP	1.4948**	0.4144	2.5753	0.1666	2.8231	-0.3945	3.3841

Threshold Part							
C	0.0245	-0.1463	0.1953	-0.1854	0.2344	-0.2741	0.3231
Slope	237.9350	-167.9360	643.8060	-261.0202	736.8902	-471.7717	947.6418
Threshold	0.0200**	0.0092	0.0307	0.0068	0.0332	0.0012	0.0388
Confidence Level		0.0200±0.0107		0.0200±0.0132		0.0200±0.0188	
R-squared	0.6856						
Adj. R-squared	0.3454						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5.2: Smooth Transition Function for Burkina Faso's Inflation Threshold



5.5.3 Cote d'Ivoire

Table 5.3 presents results of the LSTR model for inflation-growth threshold in Cote d'Ivoire. The estimation results indicate an optimal inflation value of 3.64 percent and was statistically significant at the 1 percent significance level. The coefficient of inflation in the linear part of the model is positive (1.6067) and statistically significant at the 5 percent confidence interval. At the nonlinear part, the coefficient of inflation is negative (-0.7904) but it is not statistically significant. This finding implies that below the optimal threshold of 3.64 percent, inflation can aid economic growth but above 3.64 percent, inflation will impede economic growth. Thus, implementing economic policies that ensure that inflation is below 3.64 percent in Cote d'Ivoire can have positive impact on economic growth.

Table 5.3 also shows at the 95 percent confidence interval, the inflation threshold is estimated to be 0.0364 ± 0.0082 . Though the slope coefficient is not statistically significant, the magnitude of the parameter suggests a steep transition function (see Figure 5.3). The shape of the transition function implies that inflation quickly becomes harmful to growth when it exceeds the threshold of 3.64 percent.

Table 5.3: Smooth Transition Inflation Threshold for Cote d'Ivoire

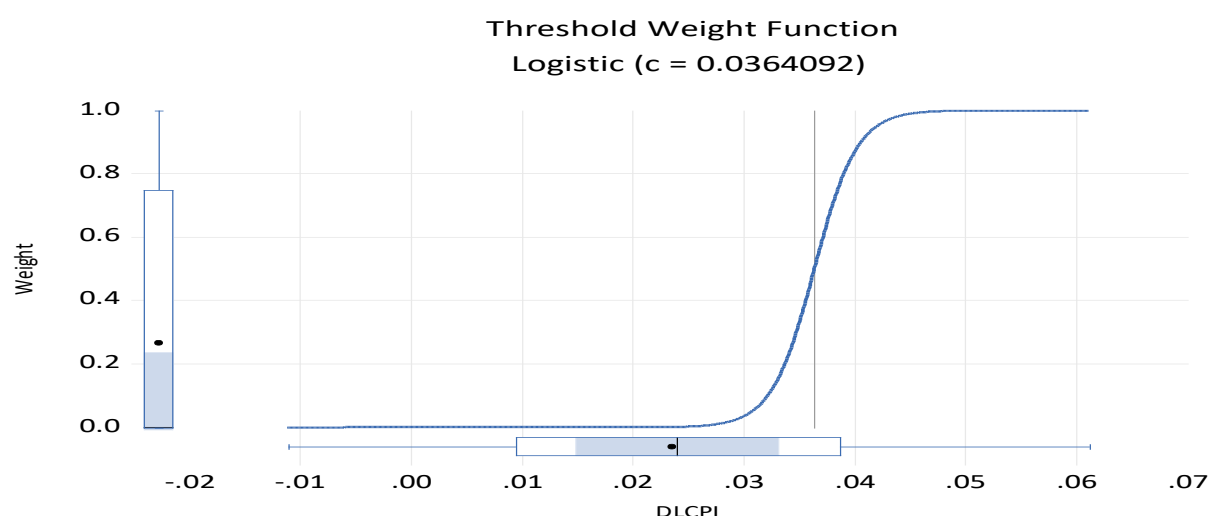
		90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DLCPI	1.6067**	-2.8723	2.3410	-3.1626	2.0507	-3.8198	3.6065
INVEST	-0.0455	-0.0980	0.0070	-0.1100	0.0190	-0.1373	0.0462
DLTOT	0.0907	-0.1044	0.2858	-0.1492	0.3305	-0.2505	0.4318
DNEXC	0.0003	0.0000	0.0006	-0.0001	0.0007	-0.0002	0.0008
DLOPEN	-0.4266**	-0.6152	-0.2381	-0.6585	-0.1948	-0.7564	-0.0969
DLPOP	-2.3827	-8.9579	4.1925	-10.4658	5.7005	-13.8801	9.1148
Nonlinear Part							

DLCPI	-0.7904	-2.3139	3.8946	-3.0259	4.6066	-4.6378	6.2185
INVEST	0.0590	-0.0357	0.1537	-0.0574	0.1754	-0.1066	0.2246
DLTOT	-0.9829**	-1.6236	-0.3422	-1.7705	-0.1953	-2.1032	0.1374
DNEXC	0.0004	-0.0009	0.0016	-0.0012	0.0019	-0.0018	0.0026
DLOPEN	0.2025	-0.4669	0.8720	-0.6205	1.0255	-0.9681	1.3731
DLPOP	2.1534	-3.8612	8.1679	-5.2406	9.5473	-8.3637	12.6704
Threshold Part							
C	0.0879	-0.0794	0.2552	-0.1178	0.2936	-0.2047	0.3805
Slope	521.6955	-670.6884	1714.0790	-944.1549	1987.5460	-1563.3090	2606.7000
Threshold	0.0364**	0.0297	0.0431	0.0282	0.0446	0.0248	0.0481
Confidence Level		0.0364±0.0067		0.0364±0.0082		0.0364±0.0117	
R-squared	0.8114						
Adj. R-squared	0.5474						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5.3: Smooth Transition Function for Cote d'Ivoire's Inflation Threshold



5.5.4 Guinea Bissau

Table 5.4 presents results of the LSTR model for inflation-growth threshold in Guinea Bissau. The threshold result indicates an optimal inflation value of 3.68 percent and the coefficient of inflation in the linear part of the model is positive (0.8962) and statistically significant at the 10 percent confidence level. Whilst at the nonlinear part, the coefficient of inflation is negative (-1.4827) and statistically significant at the 5 percent confidence level. This result implies that below the optimal threshold of 3.68 percent, inflation is favourable to growth but above 3.68 percent, inflation has a damping effect on economic growth. Therefore, adopting policies that keep inflation below 3.68 percent can enhance economic growth in Guinea Bissau.

Table 5.4 also shows the inflation threshold value, the smoothening slope parameter (γ) associated with the inflation threshold and their corresponding confidence intervals, at their 90, 95 and 99 percent confidence intervals, respectively. At the 95 percent confidence interval, the inflation threshold is estimated to be 0.0368 ± 0.1270 . Though the slope coefficient is not statistically significant, the magnitude of the parameter suggests a steep transition function (see Figure 5.4). The shape of the transition function implies that inflation quickly becomes inimical to economic growth when it exceeds the threshold of 3.68 percent.

Table 5.4: Smooth Transition Inflation Threshold for Guinea Bissau

Variable	Coef.	90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
		Low	High	Low	High	Low	High

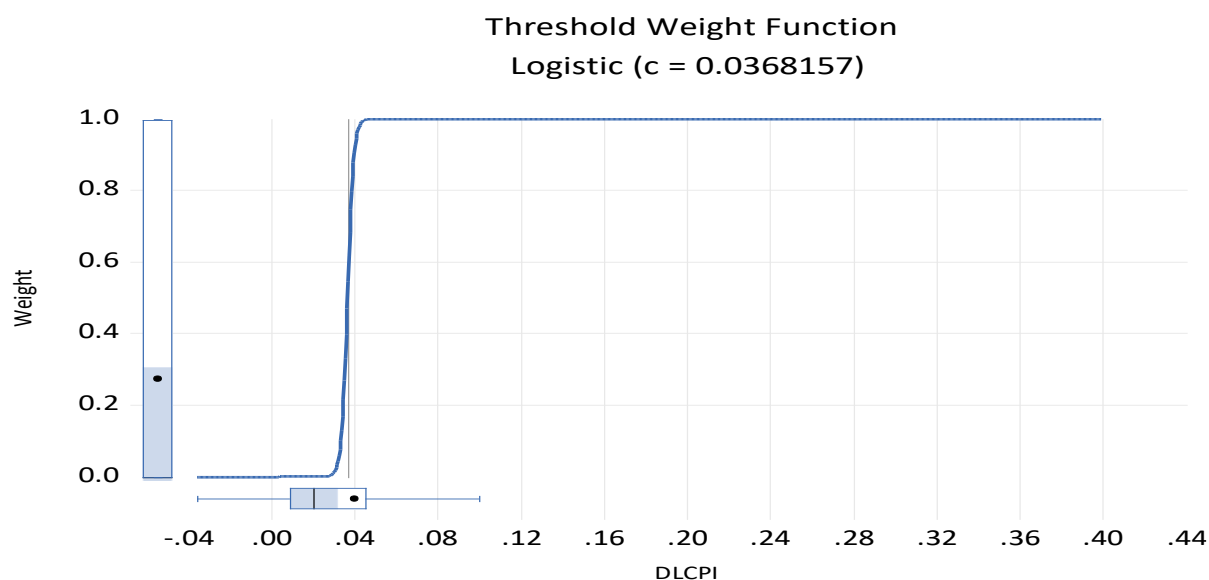
Linear Part							
DLCPi	0.8962*	0.0517	1.7408	-0.1388	1.9313	-0.5643	2.3568
INVEST	0.0191	-0.0411	0.0794	-0.0547	0.0930	-0.0851	0.1234
DLTOT	-0.0156	-0.1618	0.1306	-0.1948	0.1636	-0.2684	0.2372
DNEXC	0.0000	-0.0003	0.0004	-0.0004	0.0004	-0.0005	0.0006
DLOPEN	0.1343*	0.0194	0.2492	-0.0066	0.2751	-0.0645	0.3330
DLPOP	2.7418	-2.9512	8.4349	-4.2354	9.7190	-7.1037	12.5874
Nonlinear Part							
DLCPi	-1.4827**	-2.4003	-0.5651	-2.6073	-0.3582	-3.0696	0.1042
INVEST	0.0273	-0.2731	0.3276	-0.3408	0.3954	-0.4922	0.5467
DLTOT	2.1669**	1.5854	2.7484	1.4542	2.8795	1.1612	3.1725
DNEXC	0.0013**	0.0007	0.0020	0.0005	0.0022	0.0002	0.0025
DLOPEN	0.4855**	0.2622	0.7088	0.2119	0.7592	0.0993	0.8717
DLPOP	3.7679**	1.0453	6.4905	0.4312	7.1046	-0.9406	8.4764
Threshold Part							

C	-0.0705	-0.2085	0.0674	-0.2396	0.0986	-0.3091	0.1681
Slope	680.1463	-15981.0800	17341.3800	-19739.3800	21099.6700	-28133.8100	29494.1100
Threshold	0.0368	-0.0668	0.1405	-0.0902	0.1638	-0.1424	0.2161
Confidence Level		0.0368±0.1036		0.0368±0.1270		0.0368±0.1792	
R-squared	0.9520						
Adj. R-squared	0.8910						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5:4: Smooth Transition Function for Guinea Bissau's Inflation Threshold



5.5.5 Mali

Table 5.5 presents results of the LSTR model for inflation-growth threshold in Mali. The threshold regression result produces an optimal inflation value of 3.49 percent and was statistically significant at the 5 percent significance level. The coefficient of inflation in the linear part of the model is positive (0.7298) whilst that of the nonlinear part is negative (-

0.3050) but statistically insignificant. This finding implies that below the optimal threshold of 3.49 percent, inflation has a positive effect on growth but above 3.49 percent, inflation has a negative effect on economic growth. Therefore, adopting policies that keep inflation below 3.49 percent can have enhancing effects on economic growth in Mali. The insignificant effect of inflation in both the low and high inflation regimes could be partly attributed to the limited number of observations used in the estimation, considering the relatively short study period which is divided into low and high inflation regimes associated with the linear and nonlinear components of the estimation.

Table 5.5 also shows the inflation threshold value, the smoothening slope parameter (γ) associated with the inflation threshold and their corresponding confidence intervals i.e. their 90, 95 and 99 percent confidence intervals respectively. At the 95 percent confidence interval, the inflation threshold is estimated to be 0.0349 ± 0.0214 . Though the slope coefficient is not statistically significant, the magnitude of the parameter suggests a steep transition function (see Figure 5.5). The shape of the transition function implies that inflation quickly becomes harmful to growth when it exceeds the threshold of 3.49 percent.

Table 5.5: Smooth Transition Inflation Threshold for Mali

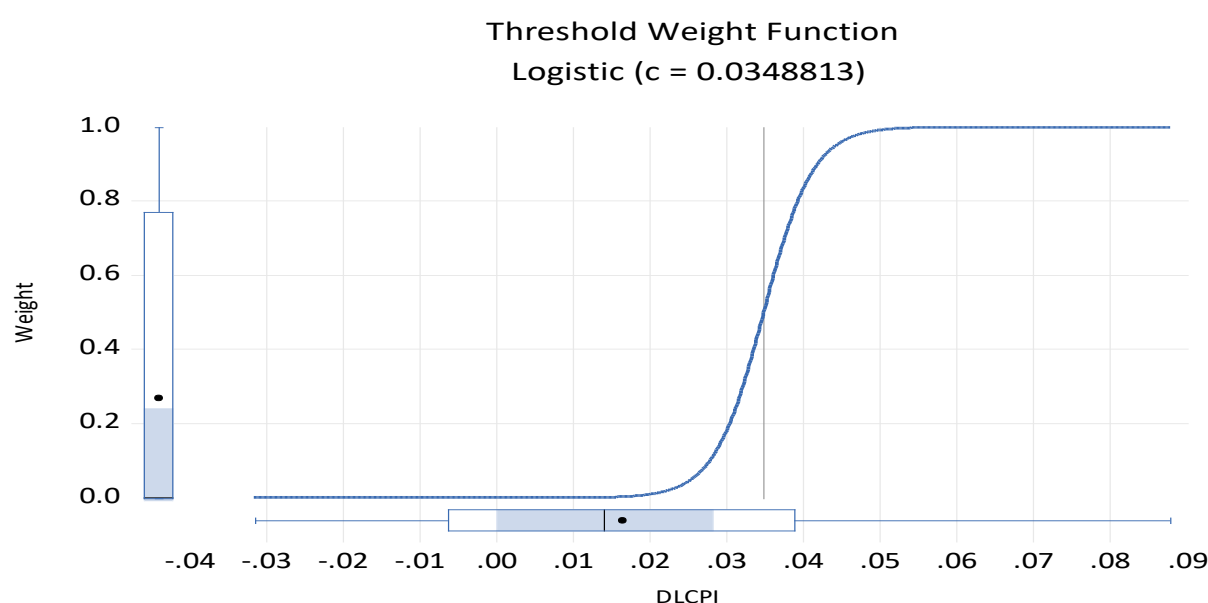
		90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DL CPI(-1)	0.7298	-1.5057	0.0460	-1.6836	0.2240	-2.0865	0.6269
INVEST	0.0618	-0.1284	0.0047	-0.1437	0.0200	-0.1783	0.0546
DLTOT	-0.0217	-0.1344	0.0910	-0.1602	0.1169	-0.2188	0.1754
DNEXC	0.0871	-0.0529	0.2270	-0.0849	0.2591	-0.1576	0.3317
DLOPEN	0.0051	-0.1521	0.1623	-0.1882	0.1984	-0.2698	0.2800
DLPOP	7.7414	-0.6808	16.1637	-2.6124	18.0952	-6.9857	22.4686
Nonlinear Part							

DLCPI(-1)	-0.3050	-3.6098	2.9998	-4.3678	3.7577	-6.0838	5.4738
INVEST	-0.0143	-0.2255	0.1971	-0.2740	0.2455	-0.3837	0.3552
DLTOT	0.6025	-0.0618	1.2668	-0.2141	1.4191	-0.5591	1.7640
DNEXC	0.0097	-1.0352	1.0547	-1.2748	1.2943	-1.8174	1.8369
DLOPEN	-0.2693	-1.4293	0.8908	-1.6954	1.1568	-2.2978	1.7592
DLPOP	2.5898	-2.0799	7.2594	-3.1508	8.3304	-5.5755	10.7551
Threshold Part							
C	-0.2236	-0.4861	0.0388	-0.5463	0.0990	-0.6826	0.2353
Slope	312.9280	-732.9468	1358.8030	-972.8123	1598.6680	-1515.8910	2141.7470
Threshold	0.0349*	0.0134	0.0563	0.0085	0.0612	-0.0026	0.0724
Confidence Level		0.0349±0.0214		0.0349±0.0264		0.0349±0.0375	
R-squared	0.8017						
Adj. R-squared	0.5242						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5.5: Smooth Transition Function for Mali's Inflation Threshold



5.5.6 Niger

Table 5.6 shows the results of the LSTR model for inflation-growth threshold in Niger. The estimated results from threshold regression model shows an optimal inflation of 3.17 percent and was statistically significant at the 1 percent significance level. The coefficient of inflation in the linear part of the model is positive (0.1706) while that of the nonlinear part is negative (-4.5326) and statistically significant at the 10 percent confidence level. This result implies that below the optimal threshold of 3.17 percent, inflation has a positive impact on growth but above 3.17 percent, inflation has a negative impact on economic growth. Thus, to maintain economic growth, Niger's policy makers should adopt policies that keep inflation below 3.17 percent otherwise, inflation above that threshold will hamper growth.

Also, in Table 5.6 the inflation threshold value, the smoothening slope parameter (γ) associated with the inflation threshold and their corresponding confidence intervals are shown. At the 95 percent confidence interval, the inflation threshold is estimated to be 0.0317 ± 0.0083 . Though the slope coefficient is not statistically significant, the magnitude of the parameter suggests a steep transition function (see Figure 5.5). The shape of the transition function implies that inflation quickly becomes harmful to growth when it exceeds the threshold of 3.17 percent.

Table 5.6: Smooth Transition Inflation Threshold for Niger

Variable	Coef.	90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
		Low	High	Low	High	Low	High

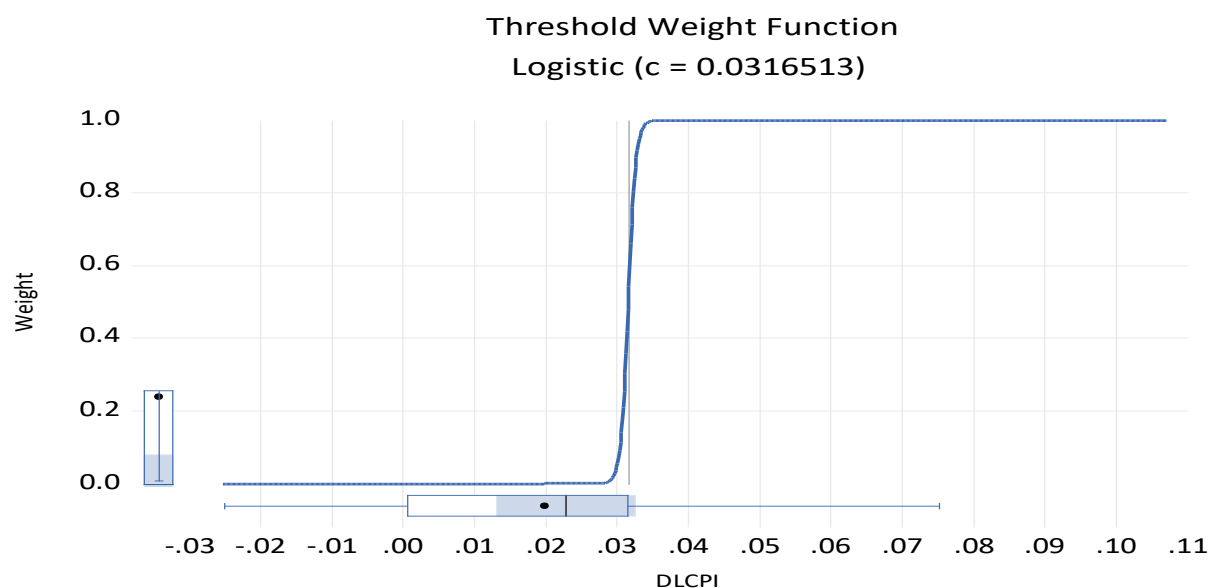
Linear Part							
DLCP(-1)	0.1706	-0.0408	0.3819	-0.0892	0.4304	-0.1990	0.5401
INVEST	0.1545**	0.0824	0.2267	0.0658	0.2432	0.0283	0.2807
DLTOT	0.0800**	0.0206	0.1395	0.0069	0.1531	-0.0239	0.1840
DNEXC	-0.0219	-0.0953	0.0516	-0.1122	0.0684	-0.1503	0.1066
DLOPEN	-0.1191**	-0.1911	-0.0472	-0.2076	-0.0307	-0.2449	0.0067
DLPOP	7.3026**	2.7204	11.8848	1.6695	12.9357	-0.7098	15.3151
Nonlinear Part							
DLCP(-1)	-4.5326*	-4.0381	8.6614	-5.4310	9.6083	-26.8700	11.7522
INVEST	0.7280**	0.1762	1.2798	0.0496	1.4063	-0.2369	1.6929
DLTOT	-14.3888*	-27.9746	-0.8029	-31.0905	2.3129	-38.1450	9.3675
DNEXC	-2.7742*	-5.3575	-0.1908	-5.9499	0.4016	-7.2914	1.7430
DLOPEN	6.5574*	0.3000	12.8148	-1.1351	14.2499	-4.3843	17.4992
DLPOP	-63.6664*	-121.8123	-5.5204	-135.1478	7.8151	-165.3405	38.0078
Threshold Part							

C	-0.2689*	-0.4384	-0.0995	-0.4772	-0.0606	-0.5652	0.0274
Slope	1877.0320	-2913.8670	6667.9310	-4012.6330	7766.6960	-6500.3430	10254.4100
Threshold	0.0317**	0.0249	0.0384	0.0233	0.0400	0.0198	0.0435
Confidence Level		0.0317±0.0068		0.0317±0.0083		0.0317±0.0119	
R-squared	0.9217						
Adj. R-squared	0.8121						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5:6: Smooth Transition Function for Niger's Inflation Threshold



5.5.7 Senegal

Table 5.7 shows the LSTR model results for inflation-growth threshold in Senegal. The estimation results show an optimal inflation threshold of 1.66 percent and was statistically significant at the 1 percent significance level. This result is consistent with the low inflation prevailing in the WAEMU zone. The coefficient of inflation in the linear part of the model is positive (0.2631) while that of the nonlinear part is negative (-0.7126) but statistically

insignificant. This result implies that below the optimal inflation threshold of 1.66 percent, the inflation effect on growth is favourable but above 1.66 percent, inflation has an unfavourable effect on economic growth. Thus, Senegalese policy makers should implement policies that can keep inflation below 1.66 percent to incentivise economic growth. The insignificant effect of inflation in both the low and high inflation regimes could be partly attributed to the limited number of observations used in the estimation, considering the relatively short study period which is divided into low and high inflation regimes associated with the linear and nonlinear components of the estimation.

Also, in Table 5.7 the inflation threshold value, the smoothening slope parameter (γ) associated with the inflation threshold and their corresponding confidence intervals are shown. At the 95 percent confidence interval, the inflation threshold for Senegal is estimated to be 0.0166 ± 0.0090 . Though the slope coefficient is not statistically significant, the magnitude of the parameter suggests a steep transition function (see Figure 5.7). The shape of the transition function implies that inflation quickly becomes harmful to growth when it exceeds the threshold of 1.66 percent.

Table 5.7: Smooth Transition Inflation Threshold for Senegal

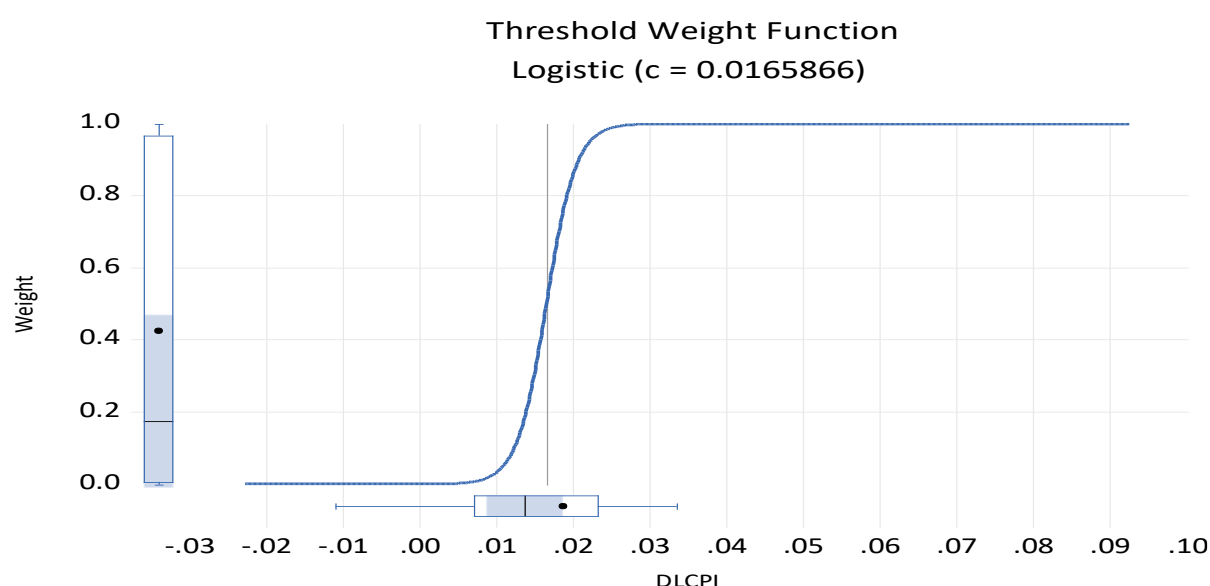
		90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DLCP	0.2631	-1.8002	1.2739	-2.1469	1.6207	-2.9213	2.3951
INVEST	0.0800	-0.0942	0.2541	-0.1335	0.2934	-0.2213	0.3812
DLTOT	0.1420	-0.1278	0.4117	-0.1886	0.4725	-0.3245	0.6084
DNEXC	0.0162	-0.1036	0.1359	-0.1306	0.1629	-0.1909	0.2233
DLOPEN	0.1263	-0.0977	0.3503	-0.1482	0.4008	-0.2610	0.5137
DLPOP	-2.0805	-8.1227	3.9617	-9.4856	5.3247	-12.5299	8.3689

Nonlinear Part							
DLCP1	-0.7126	-1.0599	2.4850	-1.4597	2.8848	-2.3527	3.7778
INVEST	0.4818	-0.3165	1.2800	-0.4965	1.4601	-0.8987	1.8623
DLTOT	-0.1931	-0.6314	0.2453	-0.7302	0.3441	-0.9511	0.5650
DNEXC	0.0060	-0.2248	0.2368	-0.2769	0.2888	-0.3931	0.4051
DLOPEN	-0.2921	-0.7978	0.2137	-0.9119	0.3277	-1.1667	0.5825
DLPOP	-2.1860*	-4.0369	-0.3350	-4.4544	0.0825	-5.3870	1.0151
Threshold Part							
C	0.0789	-0.0806	0.2384	-0.1166	0.2744	-0.1969	0.3547
Slope	521.3793	-928.3527	1971.1110	-1255.3710	2298.1290	-1985.7900	3028.5480
Threshold	0.0166**	0.0093	0.0239	0.0076	0.0256	0.0039	0.0293
Confidence Level		0.0166±0.0073		0.0166±0.0090		0.0166±0.0127	
R-squared	0.5675						
Adj. R-squared	0.3172						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5:7: Smooth Transition Function for Senegal's Inflation Threshold



5.5.8 Togo

The LSTR model results for inflation-growth threshold in Togo is shown in Table 5.8. The estimation results show an optimal inflation threshold of 3.82 percent and was statistically significant at the 1 percent significance level. This result is similar to that of the other WAEMU countries. The coefficient of inflation in the linear part of the model is positive (0.5286) while the nonlinear part is negative (-1.6451) but statistically insignificant. This result implies that below the optimal inflation threshold of 3.82 percent, inflation can promote growth in Togo but above 3.17 percent, inflation has an impeding effect on economic growth in Togo. Thus, Togolese policy makers should implement policies and programmes that can keep inflation below 3.82 percent to promote economic growth in the country. The insignificant effect of inflation in both the low and high inflation regimes could be partly attributed to the limited number of observations used in the estimation, considering the relatively short study period which is divided into low and high inflation regimes associated with the linear and nonlinear components of the estimation.

Also, in Table 5.8 the inflation threshold value, the smoothening slope parameter (γ) associated with the inflation threshold and their corresponding confidence intervals are shown. At the 95 percent confidence interval, the inflation threshold for Togo is estimated to be 0.0382 ± 0.0082 . Though the slope coefficient is not statistically significant, the magnitude of the parameter suggests a steep transition function (see Figure 5.8). The shape of the transition function implies that inflation rapidly becomes harmful to growth when it exceeds the threshold of 3.82 percent.

Table 5.8: Smooth Transition Inflation Threshold for Togo

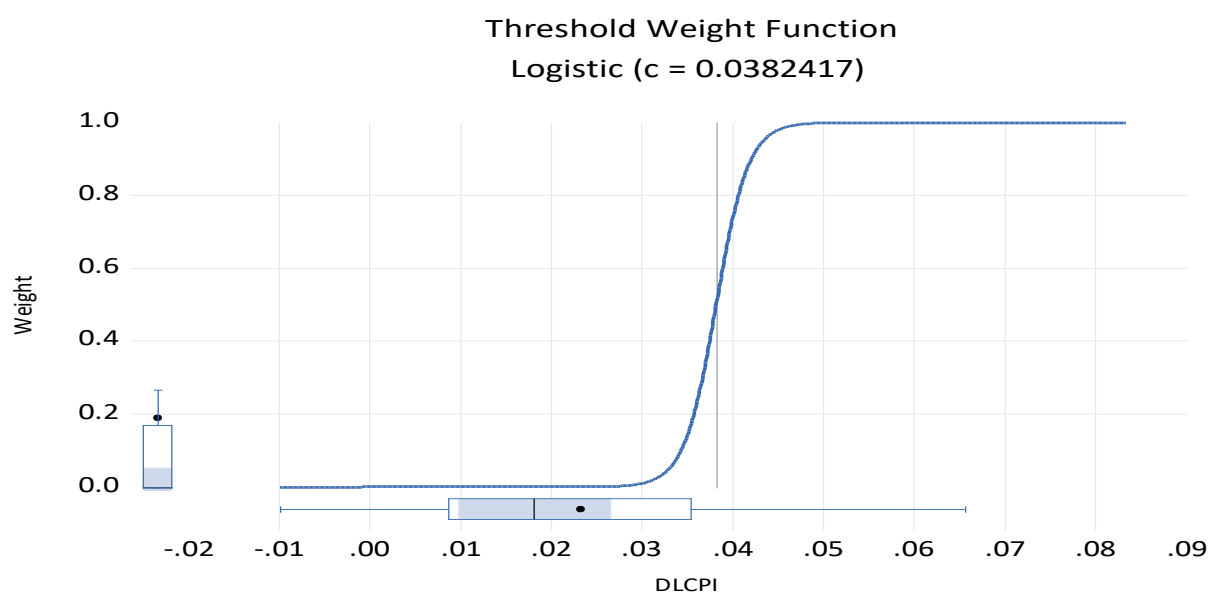
		90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DLCP1(-1)	0.5186	-0.1485	1.1857	-0.3015	1.3387	-0.6479	1.6851
INVEST	-0.0585	-0.1731	0.0561	-0.1994	0.0824	-0.2589	0.1419
DLTOT	-0.0759	-0.2802	0.1285	-0.3270	0.1753	-0.4331	0.2814
DNEXC	0.0001	-0.0002	0.0003	-0.0002	0.0003	-0.0003	0.0005
DLOPEN	0.0745	-0.1528	0.3019	-0.2050	0.3540	-0.3230	0.4721
DLPOP	-16.9407**	-23.8390	-10.0424	-25.4211	-8.4603	-29.0031	-4.8783
Nonlinear Part							
DLCP1(-1)	-1.6451	-9.8855	13.1757	-12.5300	15.8202	-18.5174	21.8076
INVEST	0.2062	-0.7323	1.1448	-0.9476	1.3600	-1.4349	1.8474
DLTOT	0.6245	-1.2833	2.5324	-1.7209	2.9699	-2.7116	3.9606
DNEXC	-0.0027	-0.0168	0.0114	-0.0201	0.0146	-0.0274	0.0219
DLOPEN	1.0959	-7.4987	9.6905	-9.4698	11.6616	-13.9326	16.1244
DLPOP	-2.5566	-19.4150	14.3018	-23.2814	18.1681	-32.0352	26.9220

Threshold Part							
C	0.4448**	0.2625	0.6271	0.2206	0.6689	0.1260	0.7636
Slope	566.3533	-1595.3580	2728.0650	-2091.1350	3223.8410	-3213.6190	4346.3260
Threshold	0.0382**	0.0315	0.0449	0.0300	0.0465	0.0265	0.0500
Confidence Level		0.0382±0.0067		0.0382±0.0082		0.0382±0.0117	
R-squared	0.7349						
Adj. R-squared	0.3636						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5:8: Smooth Transition Function for Togo's Inflation Threshold



The WAMZ Region of ECOWAS

As earlier noted, this second part of the analysis would focus on the revised results for the WAMZ Member States (Tables 5.9 to 5.14).

5.5.9 The Gambia

Table 5.9 presents the parameters from the nonlinear estimation of the LSTR model with one threshold level of inflation for The Gambia Republic. The estimation results indicate a threshold value of inflation of 4.93 percent which is statistically significant at the 1 percent significance level. This finding suggests that implementing a menu of policies and programmes that would ensure that inflation is attained below the threshold of 4.93 percent would support economic growth. Above this threshold, inflation would be harmful to growth. This outcome is reflected in the direction of inflation effects on growth, which is consistent with the predictions on the inflation-growth nonlinear relationship. The coefficient on inflation in the low inflation regime (0.0034) below this threshold associated with the linear aspect of the estimation is positive but not statistically significant. Above the threshold associated with the nonlinear component of the estimation, the effect on growth is negative (-0.0519), reflecting detrimental growth effect of inflation although not statistically significant.

Table 5.9 reports the inflation threshold value, smoothening slope parameter (γ) associated with the inflation threshold and corresponding confidence intervals of both the threshold level of inflation and the slope parameter at the confidence intervals of 90 percent, 95 percent, and 99 percent, respectively. The inflation threshold at the 95 percent confidence level is estimated to be 4.93 ± 0.0034 . While the slope coefficient is not statistically significant, the magnitude of the parameter suggests a steep transition function (see Figure 5.9). The shape of the transition function implies that inflation quickly becomes harmful to growth when it exceeds the threshold of 4.93 percent.

Table 5.9: Smooth Transition Inflation Threshold for The Gambia

Variable	Coef.	90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
		Low	High	Low	High	Low	High
Linear Part							
DLRGDP(-1)	0.1505	-0.2213	0.5223	-0.3238	0.6248	-0.5935	0.8945
DLRGDP(-2)	-2.0834**	-2.7172	-1.4496	-2.8919	-1.2749	-3.3516	-0.8152

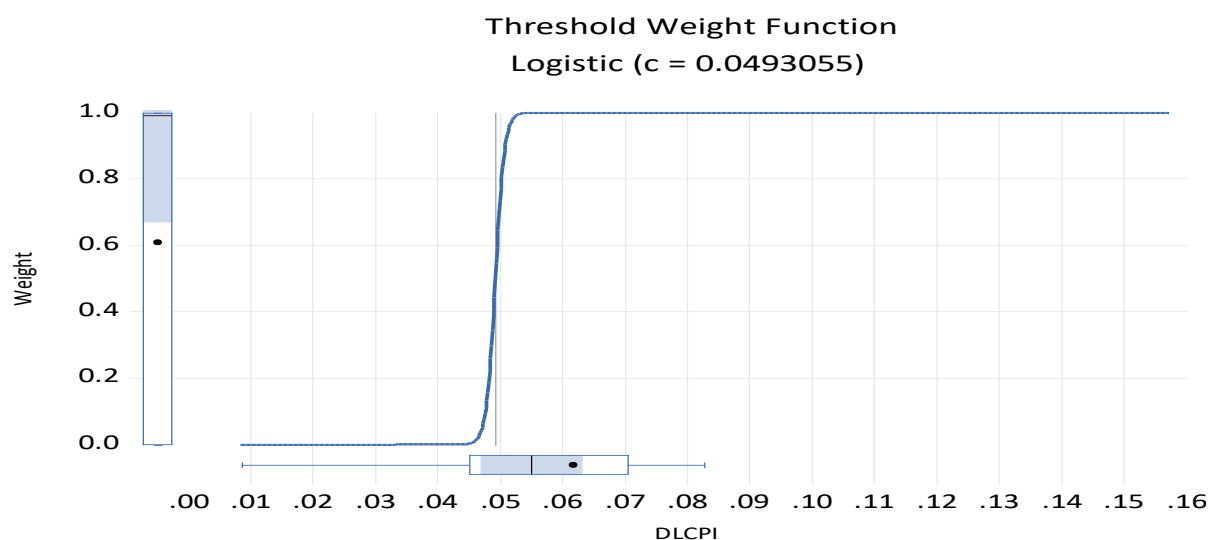
DLCP11	0.0034	-0.0210	0.0278	-0.0278	0.0345	-0.0455	0.0523
GGFCF	0.1194**	0.0600	0.1788	0.0437	0.1952	0.0006	0.2383
DLTOT	-1.1159*	-1.9210	-0.3107	-2.1430	-0.0887	-2.7270	0.4952
DLTOT(-1)	1.0101*	0.2946	1.7256	0.0973	1.9229	-0.4217	2.4419
GLNEXC	-0.1937	-0.4535	0.0662	-0.5251	0.1378	-0.7136	0.3263
DLPOP	7.0627	-17.9426	32.0679	-24.8363	38.9616	-42.9732	57.0985
NonLinear Part							
DLRGDP(-1)	0.0261	-0.8263	0.8786	-1.0613	1.1136	-1.6796	1.7319
DLRGDP(-2)	2.0307**	0.8756	3.1858	0.5572	3.5042	-0.2806	4.3420
DLCP11	-0.0519	-0.1289	0.0252	-0.1501	0.0464	-0.2060	0.1023
GGFCF	-0.1100**	-0.1932	-0.0268	-0.2161	-0.0038	-0.2764	0.0565
DLTOT	1.4473**	0.3439	2.5507	0.0397	2.8549	-0.7607	3.6552
DLTOT(-1)	-0.2065	-1.0264	0.6135	-1.2524	0.8395	-1.8471	1.4342
GLNEXC	-0.1256	-0.6061	0.3549	-0.7386	0.4874	-1.0871	0.8359
DLPOP	-1.5137	-3.0668	0.0393	-3.4949	0.4674	-4.6214	1.5939

Threshold Part							
C	-0.1074	-0.8631	0.6484	-1.0714	0.8567	-1.6196	1.4049
Slope	1379.6500	-1841.3120	4600.6110	-2729.3070	5488.6060	-5065.5450	7824.8440
Threshold	0.0493**	0.0466	0.0520	0.0459	0.0527	0.0439	0.0547
Confidence Level		0.0493±0.0027		0.0493±0.0034		0.0493±0.0054	
R-squared	0.9532						
Adj. R-squared	0.7847						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5:9: Smooth Transition Function for The Gambia's Inflation Threshold



5.5.10 Ghana

Turning to Ghana, the estimation results indicate a threshold value of inflation of 10.44 percent which is statistically significant at the 1 percent significance level. This finding suggests that implementing different policies and programmes that would ensure that inflation

is attained below the threshold of 10.44 percent would support economic growth. Above this threshold, inflation would be harmful to growth. This outcome is reflected in the direction of inflation effects on growth, which is consistent with the predictions on the inflation-growth nonlinear relationship. The coefficient on inflation in the low inflation regime (0.3479) below this threshold associated with the linear aspect of the estimation is positive and statistically significant at 10 percent level. Above the threshold associated with the nonlinear component of the estimation, the effect on growth is negative (-0.3337), reflecting detrimental growth effect of inflation although not statistically significant.

Table 5.10 reports the inflation threshold value, smoothening slope parameter (γ) associated with the inflation threshold and corresponding confidence intervals of both the threshold level of inflation and the slope parameter at the confidence intervals of 90 percent, 95 percent and 99 percent, respectively. The inflation threshold at the 95 percent confidence level is estimated to be 10.44 ± 0.01 . While the slope coefficient is not statistically significant, the magnitude of the parameter suggests a steep transition function (see Figure 5.10). The shape of the transition function implies that inflation quickly becomes harmful to growth when it exceeds the threshold of 10.44 percent.

Table 5.10: Smooth Transition Inflation Threshold for Ghana

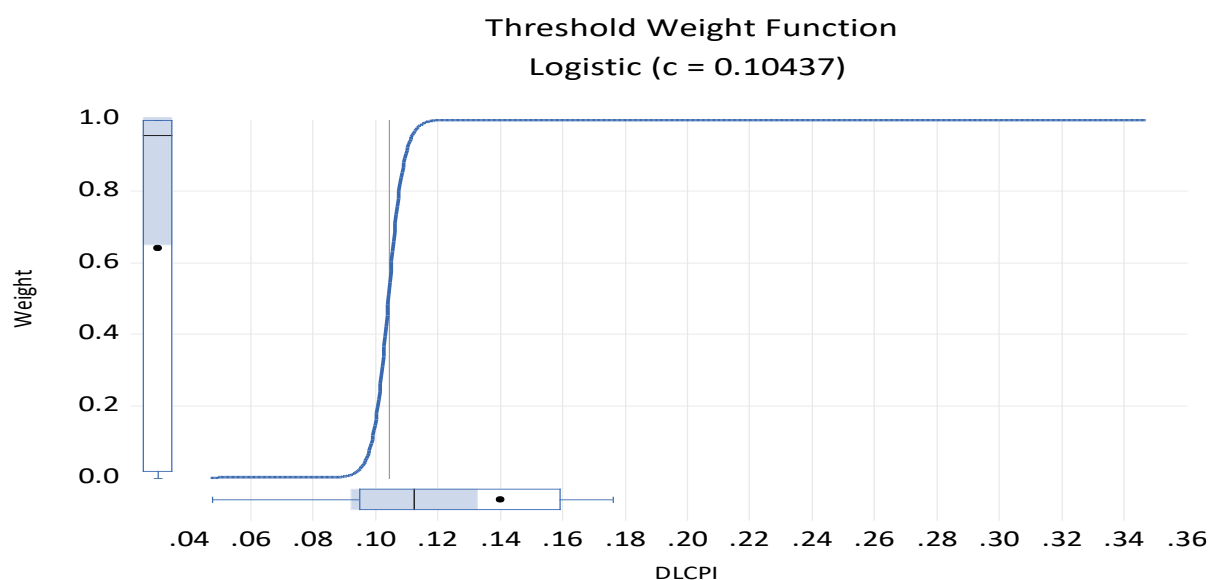
Variable	Coef.	90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
		Low	High	Low	High	Low	High
Linear Part							
DLCP1(-1)	0.3479*	0.0342	0.6617	-0.0411	0.7370	-0.2182	0.9141
GGFCF	0.0568	-0.0835	0.1971	-0.1171	0.2307	-0.1963	0.3099
DLTOT	-0.5634**	-0.9557	-0.1710	-1.0499	-0.0768	-1.2713	0.1446
GLNEXC	0.6618*	0.1057	1.2179	-0.0278	1.3514	-0.3416	1.6652
DLOIL_BR	0.0645*	0.0164	0.1127	0.0049	0.1242	-0.0223	0.1514
DLPOP	4.6621	-2.2739	11.5981	-3.9391	13.2633	-7.8533	17.1774
IT_DUM	0.1030*	0.0444	0.1616	0.0304	0.1756	-0.0027	0.2087

NonLinear Part							
DLCP(-1)	-0.3337	-0.6830	0.0156	-0.7668	0.0995	-0.9640	0.2966
GGFCF	-0.0643	-0.2259	0.0974	-0.2647	0.1362	-0.3559	0.2274
DLTOT	0.5533**	0.1111	0.9955	0.0049	1.1017	-0.2447	1.3512
GLNEXC	-0.7033**	-1.2585	-0.1481	-1.3918	-0.0148	-1.7051	0.2985
DLOIL_BR	-0.0375	-0.0953	0.0204	-0.1092	0.0342	-0.1418	0.0669
DLPOP	6.8114**	1.4147	12.2080	0.1190	13.5037	-2.9264	16.5491
IT_DUM	-0.0820**	-0.1408	-0.0232	-0.1549	-0.0090	-0.1881	0.0242
Threshold Part							
C	-0.2317**	-0.3788	-0.0845	-0.4141	-0.0492	-0.4971	0.0338
Slope	404.2302	-189.9844	998.4448	-332.6484	1141.1090	-667.9766	1476.4370
Threshold	0.1044**	0.0982	0.1106	0.0967	0.1121	0.0932	0.1156
Confidence Level		0.1044±0.0062		0.1044±0.0077		0.1044±0.0112	
R-squared	0.8775						
Adj. R-squared	0.6325						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5:10: Smooth Transition Function for Ghana's Inflation Threshold



5.5.11 Guinea

As can be seen from Table 5.11, the estimation of the LSTR model establishes an optimal inflation threshold of 9.21 percent which is statistically significant at the 5 percent level of significance. The coefficient on inflation in the lower inflation regime (0.1117) below this threshold is positive and statistically significant at the 10 percent level. The result suggests that achieving inflation below this threshold will be beneficial to growth in Guinea. The finding is consistent with the prediction on the Tobin's effect, which suggests that inflation lowers the real interest rate and by extension, the opportunity cost of investment, promoting physical capital accumulation and stimulating growth (Vaoni, 2012). As expected, the coefficient of inflation above the threshold in the upper regime associated with the nonlinear component of the estimation (-0.0663) turns out to be negative and statistically insignificant. This prediction ties with the reverse Tobin-effect phenomenon since high inflation would create distortions to relative prices and misallocation of resources which potentially impede physical capital accumulation and growth (Khan, 2014).

Table 5.11 reports the inflation threshold and slope parameter (γ) associated with the threshold level of inflation at the confidence intervals of 90 percent, 95 percent and 99 percent, respectively. Results show the estimated inflation threshold at the 95 percent confidence level at 9.21 ± 0.05 . The estimated slope parameter of the transition function ($\gamma = 41.09$) is moderate, reflecting a mild transitioning from the lower to higher inflation regime. The size of the transition function suggests that inflation moderately impedes growth when the level of inflation is attained beyond the threshold of 9.21 percent.

Table 5.11: Smooth Transition Inflation Threshold for Guinea

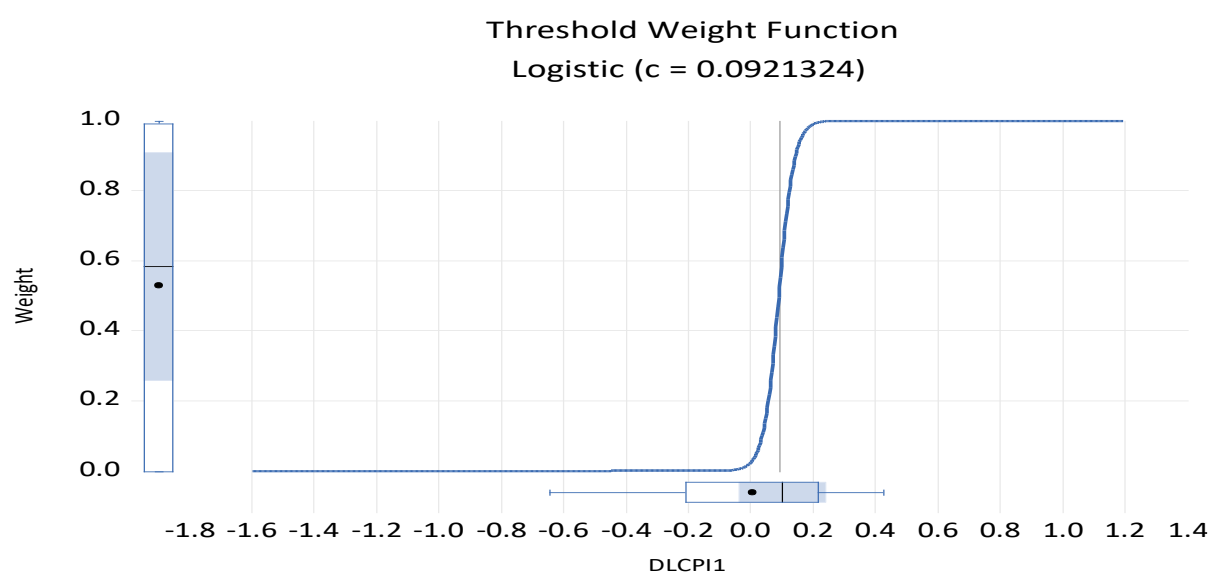
		90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DLRGDP(-1)	0.4342	-0.7685	1.6368	-1.3380	2.2063	-3.6536	4.5219
DLRGDP(-2)	-1.7209	-4.0165	0.5747	-5.1035	1.6617	-9.5234	6.0816
DLRGDP(-3)	-0.8279*	-1.6277	-0.0280	-2.0065	0.3507	-3.5465	1.8908
DLCPH	0.1117*	0.0024	0.2210	-0.0494	0.2728	-0.2598	0.4833
GGFCF	0.0080	-0.0378	0.0538	-0.0595	0.0755	-0.1476	0.1636
DLTOT	0.2632	-0.0551	0.5814	-0.2057	0.7321	-0.8184	1.3448
GLNEXC	-0.4653	-1.0255	0.0950	-1.2908	0.3602	-2.3694	1.4389
DLOIL_BR	-0.2439	-0.6487	0.1609	-0.8403	0.3526	-1.6197	1.1320
DLPOP	17.5595*	1.9894	33.1296	-5.3833	40.5024	-35.3623	70.4813
NonLinear Part							
DLRGDP(-1)	-0.8726	-2.5861	0.8408	-3.3974	1.6522	-6.6965	4.9513
DLRGDP(-2)	1.8241	-1.1600	4.8082	-2.5730	6.2213	-8.3187	11.9669
DLRGDP(-3)	-0.8156	-2.6985	1.0672	-3.5901	1.9588	-7.2154	5.5841

DLCP11	-0.0663	-0.1657	0.0332	-0.2128	0.0802	-0.4042	0.2717
GGFCF	0.0976	-0.0996	0.2949	-0.1930	0.3883	-0.5728	0.7680
DLTOT	-0.0092	-0.3698	0.3514	-0.5406	0.5222	-1.2349	1.2165
GLNEXC	0.5737	-0.1336	1.2810	-0.4686	1.6159	-1.8304	2.9777
DLOIL_BR	0.2454	-0.1577	0.6484	-0.3485	0.8392	-1.1245	1.6152
DLPOP	-3.9190	-10.2323	2.3944	-13.2218	5.3839	-25.3777	17.5397
Threshold Part							
C	-0.2234	-0.4638	0.0170	-0.5776	0.1309	-1.0405	0.5937
Slope	41.0932	-12.8054	94.9918	-38.3274	120.5137	-142.1046	224.2910
Threshold	0.0921**	0.0579	0.1263	0.0418	0.1425	-0.0241	0.2083
Confidence Level		0.0921±0.0342		0.0921±0.0504		0.0921±0.1162	
R-squared	0.9937						
Adj. R-squared	0.9312						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5.11: Smooth Transition Function for Guinea's Inflation Threshold



5.5.12 Liberia

The LSTR estimation results reported in Table 5.12 reveal that the inflation threshold of 8.72 percent is statistically significant at the 1 percent significance level. Turning to the inflation variable of interest, the coefficient (1.5856) shows that achieving inflation below the threshold of 8.72 percent would positively impact growth in the lower regime. However, the inflation growth effect is not significant in the lower regime. At the higher regime (nonlinear part), the coefficient of inflation is (-4.4024) which points to growth-retarding effect of inflation above the threshold, and it is statistically significant at 10 percent level.

Table 5.12 displays the inflation threshold value and the slope parameter (γ) associated with the inflation threshold at the confidence intervals of 90 percent, 95 percent and 99 percent, respectively. The results show the estimated inflation threshold at the 90 percent confidence level at 8.72 ± 0.02 . The size of the estimated slope coefficient (130.22) reflects a sharp change in the growth effect of inflation when transitioning from the lower to the upper inflation regimes. This finding suggests that obtaining a level of inflation above the threshold is inimical to growth.

Table 5.12: Smooth Transition Inflation Threshold for Liberia

		90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DLRGDP(-1)	0.3634	-0.2666	0.9934	-0.4403	1.1671	-0.8972	1.6240

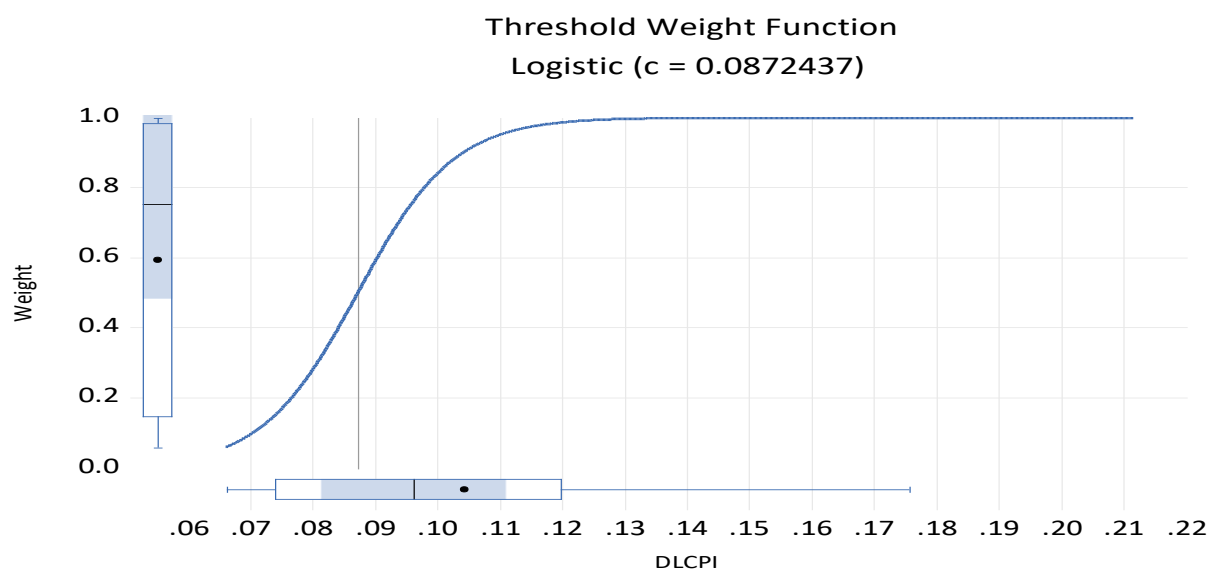
DLRGDP(-2)	-0.7601**	-1.3432	-0.1770	-1.5039	-0.0163	-1.9268	0.4067
DLCPI(-1)	1.5856	-1.0320	4.2032	-1.7536	4.9248	-3.6522	6.8234
GGFCF	-0.0792	-0.2408	0.0824	-0.2853	0.1270	-0.4025	0.2442
DLTOT	0.4129	-0.3908	1.2167	-0.6124	1.4382	-1.1953	2.0212
GLNEXC	-1.2600*	-2.4866	-0.0333	-2.8248	0.3048	-3.7145	1.1945
DLOIL_BR	-0.1080	-0.2887	0.0727	-0.3386	0.1225	-0.4696	0.2536
DLPOP	8.0019*	1.0373	14.9666	-0.8828	16.8867	-5.9345	21.9383
NonLinear Part							
DLRGDP(-1)	-0.6606	-1.3525	0.0313	-1.5433	0.2220	-2.0452	0.7239
DLRGDP(-2)	0.4762	-0.1541	1.1066	-0.3279	1.2803	-0.7851	1.7375
DLCPI(-1)	-4.4024*	-7.9227	-0.8822	-8.8932	0.0883	-11.4465	2.6417
GGFCF	0.1695	-0.0151	0.3541	-0.0660	0.4050	-0.1999	0.5389
DLTOT	-1.5177**	-2.6082	-0.4273	-2.9088	-0.1267	-3.6997	0.6642
GLNEXC	1.5444*	0.1995	2.8893	-0.1713	3.2601	-1.1468	4.2356
DLOIL_BR	0.1703	-0.1027	0.4433	-0.1780	0.5185	-0.3760	0.7165
DLPOP	10.6440*	2.0906	19.1974	-0.2675	21.5555	-6.4714	27.7595

Threshold Part							
C	-0.2068**	-0.2897	-0.1239	-0.3126	-0.1011	-0.3727	-0.0409
Slope	130.2157	-35.9946	296.4261	-81.8176	342.2490	-202.3738	462.8052
Threshold	0.0872**	0.0735	0.1010	0.0697	0.1048	0.0597	0.1148
Confidence Level		0.0872±0.0138		0.0872±0.0175		0.0872±0.0275	
R-squared	0.9889						
Adj. R-squared	0.9488						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5.12: Smooth Transition Function for Liberia's Inflation Threshold



5.5.13 Nigeria

Table 5.13 presents the estimation results of the LSTR model, suggesting a threshold level of inflation of 10.50 percent which is statistically significant at the 1 percent level. By allowing for one period lag in inflation, the results of the Wald test for the joint significance indicate that the combined coefficient on inflation in the low inflation regime are statistically

significant. The evidence is an indication that inflation spurs growth in this regime below the threshold level. The result suggests that moderate inflation will be beneficial to growth in Nigeria if maintained at levels below the threshold. The combined coefficient turns out to be negative although not statistically significant in the upper regime above the threshold, pointing to the detrimental impact of inflation on growth above the threshold value of 10.50 percent.

Table 5.13 presents the inflation threshold value and the slope parameter (γ) associated with the inflation threshold at the confidence intervals of 90 percent, 95 percent and 99 percent, respectively. The results reveal the estimated threshold inflation rate of 10.50 ± 0.03 at the 95 percent confidence level. The estimated slope parameter (44.14) reveals a relatively moderate transition function. This evidence suggests that the transmission of the undesirable effects of inflation to growth above the threshold occurs at a relative lower speed. The outcome may reflect recent policy gains induced by Central Bank interventions to address some of the supply-side constraints especially boosting domestic food production.

Table 5.13: Smooth Transition Inflation Threshold for Nigeria

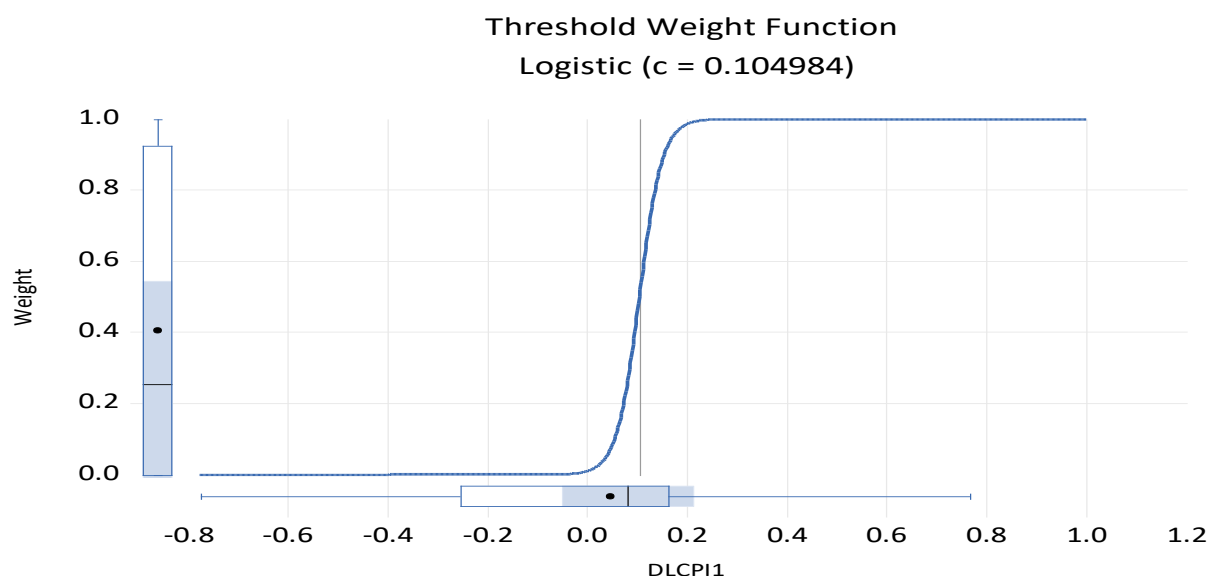
		90% Confidence Interval		95% Confidence Interval		99% Confidence Interval	
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DLRGDP(-1)	0.6700**	0.1853	1.1547	0.0597	1.2803	-0.2547	1.5948
DLCPI1	0.0066	-0.0409	0.0541	-0.0532	0.0664	-0.0840	0.0972
DLCPI1(-1)	0.0334**	0.0120	0.0548	0.0064	0.0604	-0.0075	0.0743
GGFCF	-0.1001**	-0.1745	-0.0258	-0.1937	-0.0065	-0.2420	0.0418
DLTOT	0.1193	-0.1456	0.3843	-0.2143	0.4530	-0.3862	0.6249
GLNEXC	-0.0410**	-0.0722	-0.0099	-0.0803	-0.0018	-0.1005	0.0184
DLOIL_BR	-0.0929**	-0.1619	-0.0239	-0.1798	-0.0060	-0.2246	0.0388
DLPOP	-23.7265**	-38.5557	-8.8973	-42.3999	-5.0531	-52.0194	4.5664

NonLinear Part							
DLRGDP(-1)	-1.1348	-2.3181	0.0485	-2.6249	0.3552	-3.3925	1.1228
DLCPH1	-0.0059	-0.0748	0.0631	-0.0927	0.0809	-0.1374	0.1257
DLCPH1(-1)	-0.0418	-0.1159	0.0323	-0.1351	0.0515	-0.1832	0.0996
GGFCF	-0.1980	-0.7090	0.3129	-0.8414	0.4454	-1.1728	0.7768
DLTOT	-0.0568	-0.6283	0.5147	-0.7764	0.6629	-1.1472	1.0336
GLNEXC	-0.1324	-0.3624	0.0975	-0.4220	0.1571	-0.5712	0.3063
DLOIL_BR	0.1587*	0.0269	0.2906	-0.0073	0.3247	-0.0928	0.4103
DLPOP	0.2815	-2.4980	3.0610	-3.2185	3.7816	-5.0215	5.5846
Threshold Part							
C	0.6628**	0.2785	1.0472	0.1789	1.1468	-0.0705	1.3961
Slope	44.1401*	1.4159	86.8642	-9.6595	97.9396	-37.3740	125.6542
Threshold	0.1050**	0.0753	0.1346	0.0677	0.1423	0.0484	0.1615
Confidence Level		0.1050±0.0296		0.1050±0.0373		0.1050±0.0566	
R-squared	0.9530						
Adj. R-squared	0.8121						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5:13: Smooth Transition Function for Nigeria's Inflation Threshold



5.5.14 Sierra Leone

In Sierra Leone (as shown in Table 5.14 below), the estimation of the LSTR model shows an inflation threshold of 6.96 percent that is statistically significant at the 1 percent level of significance. Consistent with the literature on the inflation-growth nonlinearity, the coefficient of inflation in the lower inflation regime (0.6276) below this threshold is positive and statistically significant at the 1 percent level. This is evidence showing the growth-promoting effects when moderate levels of inflation are achieved below the inflation threshold. Moving from the lower inflation regime to the upper regime above the threshold, the coefficient of inflation (-0.3651) turns out to be negative and statistically significant, reflecting the growth-retarding effect of inflation above the threshold.

Table 5.14 reports the estimated inflation threshold and slope parameter (γ) associated with the threshold level at the confidence intervals of 90 percent, 95 percent, and 99 percent, respectively. Results show the estimated inflation threshold of 6.96 ± 0.006 at the 95 percent confidence interval. The estimated slope parameter indicates a relatively higher value of the slope of transition function ($\gamma = 2342.25$), reflecting a sharper transitioning from the lower to higher inflation regime. This finding implies that obtaining inflation levels above the threshold would trigger a speedy transmission of the adverse effect of inflation on growth in Sierra Leone.

Table 5.14: Smooth Transition Inflation Threshold for Sierra Leone

		90% Confidence Interval	95% Confidence Interval	99% Confidence Interval

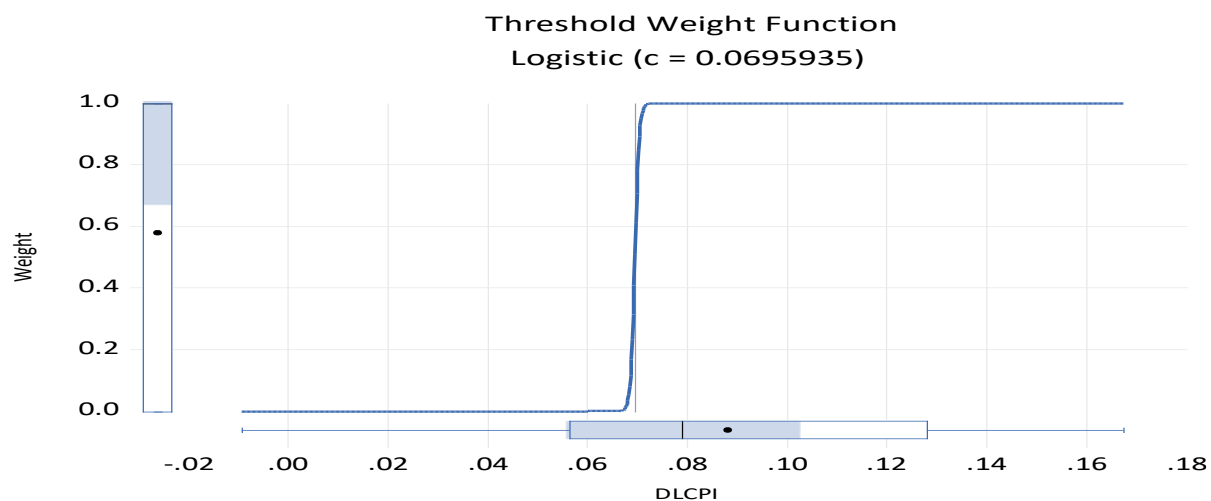
Variable	Coef.	Low	High	Low	High	Low	High
Linear Part							
DLRGDP(-1)	0.8640	-0.2925	2.0204	-0.8401	2.5680	-3.0667	4.7947
DLRGDP(-2)	-0.6794	-1.5964	0.2377	-2.0307	0.6719	-3.7964	2.4376
DLRGDP(-3)	-0.0438	-1.3991	1.3116	-2.0409	1.9534	-4.6506	4.5631
DLCPI	0.6276	-2.6439	3.8991	-4.1930	5.4482	-10.4920	11.7472
GGFCF	0.0262	-0.0544	0.1069	-0.0926	0.1451	-0.2479	0.3004
DLTOT	2.6476	-2.0257	7.3209	-4.2386	9.5338	-13.2367	18.5319
GLNEXC	-0.5435	-2.1390	1.0520	-2.8945	1.8075	-5.9665	4.8795
DLOIL_PR_BR	0.1772	-0.0475	0.4018	-0.1539	0.5082	-0.5865	0.9408
DLPOP	-0.5712	-8.7468	7.6044	-12.6181	11.4757	-28.3595	27.2171
NonLinear Part							
DLRGDP(-1)	-0.8813	-2.1811	0.4185	-2.7966	1.0339	-5.2992	3.5366
DLRGDP(-2)	0.8189	-0.1244	1.7622	-0.5711	2.2088	-2.3873	4.0251
DLRGDP(-3)	0.2603	-1.0299	1.5504	-1.6408	2.1613	-4.1249	4.6454
DLCPI	-0.3651	-3.6043	2.8741	-5.1382	4.4079	-11.3750	10.6447
GGFCF	-0.1245	-0.6469	0.3979	-0.8943	0.6453	-1.9002	1.6512
DLTOT	-2.6215	-7.3014	2.0584	-9.5174	4.2745	-18.5282	13.2852

GLNEXC	0.5014	-1.1577	2.1605	-1.9433	2.9461	-5.1377	6.1405
DLOIL_PR_BR	-0.1674	-0.3875	0.0528	-0.4918	0.1570	-0.9157	0.5809
DLPOP	-2.1833	-14.1349	9.7683	-19.7942	15.4276	-42.8061	38.4395
Threshold Part							
C	0.0726	-0.0556	0.2007	-0.1163	0.2614	-0.3631	0.5083
Slope	2342.2530	-49662.0500	54346.5600	-74287.0500	78971.5600	-174417.0000	179101.5000
Threshold	0.0696**	0.0655	0.0737	0.0636	0.0756	0.0558	0.0834
Confidence Level		0.0696±0.0041		0.0696±0.0060		0.0696±0.0138	
R-squared	0.9968						
Adj. R-squared	0.9653						

Note: ** and * denote 5% and 10 %, respectively. Dependent variable - Growth in real GDP.

Source: WAMI Staff estimates using EViews 13

Figure 5:14: Smooth Transition Function for Sierra Leone's Inflation Threshold



5.6 Synopsis of Estimated Optimal Inflation-Growth Results in ECOWAS Region

Table 5.15 provides the summary of all the estimated optimal inflation-growth results in the ECOWAS region. It is interesting to note that optimal inflation-growth threshold in the WAEMU countries is generally far lower than that of the WAMZ Countries. This may be attributed to the fact that WAEMU countries are currently in a common currency union, their currency, West African CFA franc is pegged to the Euro, and this appears to be providing some level of price stability, unlike the WAMZ.

Looking at the inflation thresholds for The ECOWAS region (see Table 5.15), it is obvious that Benin republic (1.33%) has the lowest inflation threshold, followed by Senegal (1.66%) and Burkina Faso (2.00%). Niger (3.17%), Mali (3.49%), Cote-I'voire (3.64%), Guinea-Bissau (3.68%) and Togo (3.89%) have inflation-growth threshold hovering around 3 to 4 percent in the WAEMU region. This is contrary to the WAMZ countries where Nigeria (10.50%) has the highest inflation-growth threshold in the region, followed by Ghana (10.44%), Guinea (9.21%), Liberia (8.72%), Sierra Leone (6.96%) and The Gambia (4.93%), where average inflation-growth threshold hovering around 8 to 9 percent in the WAMZ region. These findings suggest a potential difference in inflation tolerance levels between ECOWAS (WAEMU and WAMZ) region.

Table 5.15: Synopsis of Estimated Results - Optimal Inflation-Growth in ECOWAS Region

S/N	WAEMU Countries	Threshold Inflation	S/N	WAMZ Countries	Threshold Inflation
1	Benin	1.33%	1	The Gambia	4.93%
2	Burkina Faso	2.00%	2	Ghana	10.44%
3	Cote-IVoire	3.64%	3	Guinea	9.21%
4	Guinea Bissau	3.68%	4	Liberia	8.72%
5	Mali	3.49%	5	Nigeria	10.50%
6	Niger	3.17%	6	Sierra Leone	6.96%
7	Senegal	1.66%			

8	Togo	3.82%			
9	Cabo Verde ¹	-			
	Average	2.85%		Average	8.46%

Source: Authors' Computations

¹ Note that Cabo Verde is not a member of the WAEMU and just included for completeness purpose in Table 5.15.

This result is similar to that found by Sanga and Gui-Diby (2020) and WAMA (2018), where average inflation-growth threshold is far lower for the WAEMU countries than the WAMZ region within the ECOWAS. The implication of this result is that WAEMU countries inflation-growth nexus are likely to be optimised at the lower single digits of inflation, thus, having lower tolerance for high level of inflation while countries in the WAMZ appears to have more capacity to absolve more inflationary pressures and thus optimise inflation-growth in the zone at the upper end of the single digits of inflation. Hence, the current ECOWAS Convergence criteria where the same level of lower single digit of inflation (5 percent) is being applied across all ECOWAS regions may not be growth enhancing for all the member states, particularly in the WAMZ, where there appear to be more inflationary tolerance and capacity to absolve higher level of inflation for growth purposes. Therefore, there may be need to revisit this issue in order to determine the appropriate inflation-growth threshold for all ECOWAS member states.

It is quite remarkable to note that in virtually all the ECOWAS Member States, the estimated LSTR models indicate an inflation threshold that is statistically significant at the 1 percent level of significance. Also, the estimated models are consistent with the nonlinearity inflation-growth literature, where the coefficient of inflation in the lower inflation regime (below the threshold) is positive, suggesting that inflation is having growth-promoting effects when moderate levels of inflation are achieved. On the other hand, the coefficient of inflation appears to be negative in the upper inflation regime (above the threshold), reflecting the growth-retarding effect of inflation above the threshold. In another vein, for most of the estimated models, the size of the slope parameter of the transition function indicates that inflation quickly retards growth above the recommended threshold. This finding has important implications for policy responses to curb inflation in ECOWAS Member States. The outcome suggests the need for prompt policy responses when the level of inflation is at or above the estimated threshold to avoid the undesirable effects on economic growth.

6.0 Summary, Conclusion and Policy Recommendations

This study examines country-specific empirical evidence on the optimal inflation-growth threshold in the ECOWAS region comprising both WAEMU and WAMZ countries, over the period 1996-2022. Determining the inflation-growth threshold below which moderate inflation spurs growth, but above which inflation is detrimental to growth is very important for monetary policy actions in the region to curb high inflation and thus mitigate the effects of distortionary policy on the economy. Although there is large empirical literature on this subject, however, previous studies generally focused on exogenous approaches of determining optimal inflation which has been found to impose a sharp and most often linear behaviour on the threshold level of inflation. This paper contributes to the policy debate on the inflation-growth nexus in three-folds. Unlike previous studies, it endogenously determines the individual country-specific threshold level of inflation on economic growth for ECOWAS countries, allowing for heterogeneous inflationary episodes over time. It uses recent methodology of smooth transition regression that allows for gradual shifts among high and low inflation regimes in determining the threshold inflation-growth for each ECOWAS member states and lastly, it focuses on the recent period of 1996-2022, hence, making the results of the study more policy relevant, by capturing recent macroeconomic shocks experienced by the countries.

Preliminary results from the study shows interesting optimal inflation rates for each of the ECOWAS countries with three different confidence intervals of 90 percent, 95 percent and 99 percent, associated with low and high inflation regimes, that is, below and above this threshold, respectively. The estimated results are divided into three components, comprising the linear, nonlinear and the estimated inflation threshold part (where most of the interpretations are focused). For most of the countries in ECOWAS, it is clear that the linear coefficient of inflation in the low inflation regime is positive and consistent with the theoretical proposition where there is positive effect of attaining lower levels of inflation on economic growth. While in the contrary, the nonlinear coefficient of inflation in the high inflation regime is strongly negative, suggesting that the adverse effects of high inflation on growth are evidenced. This implies that elevated levels of inflation above the established threshold would constraint growth in the ECOWAS (WAEMU and WAMZ) region. This clearly points to the fact that there is need for prompt policy responses when the level of inflation is at or above the estimated threshold for each member states, to avoid the undesirable effects on economic growth.

The estimated results further indicate that inflation threshold coefficients for WAEMU countries are Benin (1.33%); Burkina Faso (2.00%); Cote-I'voire (3.64%); Guinea-Bissau (3.68%); Mali (3.49%); Niger (3.17%); Senegal (1.66%) and Togo (3.89%), all having inflation-growth threshold hovering around 2 to 4 percent in the region. These threshold coefficients are quite different from that of the WAMZ countries where The Gambia (4.93%); Ghana (10.44%); Guinea (9.21%); Liberia (8.72%); Nigeria (10.50%) and Sierra Leone (6.96%), all having a relatively higher inflation-growth threshold in the region, hovering around 8 to 9 percent. The findings provide further useful insights as it provides strong empirical support for the policy stance of ECOWAS countries regarding the convergence

criterion to contain inflation to a single-digit level. These findings suggest a potential difference in inflation tolerance levels between ECOWAS (WAEMU and WAMZ) region.

In other words, it clearly revealed that WAEMU countries inflation-growth nexus are likely to be optimised at the lower single digits of inflation, thus, having lower tolerance for high level of inflation while countries in the WAMZ appears to have more capacity to absolve more inflationary pressures and thus optimise inflation-growth in the zone at the upper end of the single digits of inflation. Hence, the current ECOWAS Convergence criteria where the same level of lower single digit of inflation (5 percent) is being applied across all ECOWAS regions may not be growth enhancing for all the member states, particularly in the WAMZ, where there appear to be more inflationary tolerance level and capacity to absolve relatively higher level of inflation. Therefore, there may be need to revisit this issue in order to determine appropriate inflation-growth threshold for all ECOWAS member states. Alternatively, there may be the need for the ECOWAS region to consider possibility of having a “range” inflation convergence criterion rather than a “point”, which is currently being practised.

Lastly, the limitation of this study is that it does not consider sectoral importance of inflation at the country level as well as country-specific transmission channels of inflation to growth in the ECOWAS region. Future research exercise to determine the level of inflation that will be beneficial to growth in these sectors as well as the country-specific transmission channels that will be relevant for policymaking in the ECOWAS is suggested.

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Appendix 1: Description of variables and sources

Main Variables	Denotation	Description	Sources
Growth rate of real GDP	DLGDP	First difference of the logarithm of real GDP.	Penn World Table (PWT), version 10.10 and World Development Indicators (WDI).
Inflation rate (threshold variable)	DLCPI	Annual percent change of Consumer Price Index (CPI)	IMF's World Economic Outlook (WEO) and World Development Indicators (WDI).
Control Variables			
Investment to GDP ratio	GGFCF	Share of gross fixed capital formation in GDP.	PWT, version 10.10 and World Development Indicators (WDI)
Growth in terms of trade (TOT)	DLTOT	Computed as the ratio of the price level of exports to the price level of imports and growth in TOT as the first difference of the logarithm of TOT.	PWT, version 10.10 and World Development Indicators (WDI)
Nominal exchange rate changes	GLNEXC	First difference of the logarithm of nominal exchange rate.	IMF's WEO database and World Development Indicators (WDI)
Oil Price changes	DLOIL_BR	First difference of the logarithm of Brent Crude Oil Price.	IMF's WEO database
Population growth	DLPOP	First difference of the logarithm of total population.	PWT, version 10.10 and World Development Indicators (WDI)